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Potentialities of Dairy Production of Local Cattle Raised In Rural Environment In Northern Ivory Coast

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ABSTRACT

Despite significant investment made by Ivorian authorities to develop livestock production since the independence, the local production is dependant to the external production. This study aims to underline the real dairy performances of local cattle breeds (N'Dama, Méré and Métis) raised in rural conditions. The designation ''Métis'' has been given to animals recognized as crossbred, but of unknown parents. Three parameters (Milk production, Duration of lactation and Calving interval) was studied in six rural localities of the northern region of Ivory Coast. The results showed that milk quantity produced by Métis cattle, 262±77 kg were significantly higher than those of the two other cattle. Méré cattle with 223.3±64 of milk, was significantly different from N'Dama breed (193.53±46.76 kg). Quantity of milk produced and duration of lactation were significantly influenced by genetic type (N'Dama, Méré, Métis), age, calving season. But it was not the same case for calving interval. Inadequate natural and technical environment affect the genetic potential of local breeds expression. Adequate management conditions could substantially enhance the dairy performances of local cattle.
Keywords: Local cattle, milk, productivity, breeds expression.

INTRODUCTION

The Ivorian dairy products market is inadequately supplied by domestic production. Ivory Coast is dependent on imports for milk, up to 83 %. In effect, country produces only 17% of its consumption (MPARH, 2012).
Despite significant investment made by Ivorian authorities to develop livestock production since the independence, the local production is dependant to the external production (Atsé and Gbodjo, 1998). In the perspective of self-sufficiency in this field, important efforts have to be made.
Despite their low-use in the dairy system, local cattle breeds presents several advantages, including local cattle breeds which are adapted to the environment (trypanotolerant cattle

breeds), abundant food resources (large areas of natural pastures, forage crops with high yields, abundant agro-industrial products) (Rege *et al*., 1994).

However, a meticulous observation of this sector shows a set of climatic, parasitological and technical disadvantage in animal production (Agyemang *et al*., 1987). Knowing the starting performance, one can easily appreciate the genetic progress that will result from improved local breed animals.

This study underlines the potentialities of local cattle breeding in rural area. Milk production and associated parameters were studied according environmental factors (calving season, cow age, and animal illness)

MATERIAL AND METHODS

Sampling

This study was achieved in some localities of Boundiali, region in the north of Ivory Coast. A river called Bagoue crosses the region from south to north and the accompanying gallery forest represents the main tsetse habitat.

A survey was conducted to identify farming areas where there were tsetse flies. Then, farmers who were selected were sensitized to their participation and collaboration in the achievement of this study.

Thus, animals included in this study are N'Dama, Méré and Métis raised in six (06) rural localities (Nondara, Sissedougou, Ponondougou, Landiougou, Kouto and Kantara). The most common farming system in this region is the traditional sedentary system.

Méré cattle is a crossbreed between local trypanotolerant taurine breeds (Baoulé breed mainly) and zebu breeds mainly originated from Burkina Faso and Mali (Sokouri *et al*., 2007).

The designation ''Métis'' has been given to animals recognized as crossbred, but their parents are unknown.

The main sampling criterion of a cow was based on the regularly treatment of animals by the herdsman. In total, seven (08) herds distributed in the six localities cited above, were selected. There were two herds of N'Dama cattle in Nondara and one herd in Sissédougou. For Méré Cattle, there were four (04) herds distributed in Kouto, Landiougou, Nondara and Ponondoougou. Métis cattle were only found in Kantara.

All animals monitored under this study were identified by a number marked on both a metal plate to one of the ears and to a plastic plate to the other ear. This precaution was taken to avoid losses which overcome in the different places of grazing.

Data collection

Parasitological data

Hematology

Blood was collected using a capillary tube. A drop is used to make a smear. The capillary tube is then centrifuged for 5 minutes on site. Centrifugation allowed separation of plasma and blood elements. The tube is cut with a diamond pen 1 mm below the BUFFY COAT (plasma interface and red blood cells) to include the red cells. This levy is observed under microscope and can see trypanosomes and microfilariae. The smear is fixed with methanol and stained with Giemsa in laboratory. It serves to determine trypanosome species, Theileria, Babesia and of anaplasma. Observations are done under microscope with an immersion objective.

Coprology

The stool examination was also done in laboratory. Two methods were used; sedimentation method and Mc Master Technique.

Sedimentation method

It consists in searching heavy fluke eggs. A mixture of 3 mg of fecal material in 30 ml of water is made. Then this mixture is mechanically disintegrated. The homogenate is filtered through a sieve opening of 80 microns. The filtrate is centrifuged for 5 minutes, then the supernatant is removed, the pellet is suspended again in a 10 ml conical tube. At each stage the glass and the sieve are washed. The used water is added to the sample. A second centrifugation occurs, and the supernatant removed. Pellet in a drop of methylene blue was added to 1%. The eggs of the liver fluke yellow are visible on the blue background (Troncy *et al*., 1991).

Mc Master Technique

It quantifies eggs of strongyles, Strongyloides, coccidia and tapeworms. The first three steps are the same as sedimentation method. At the fourth step 10 ml of saturated sodium chloride solution must be added to deposit, and then the solution must be homogenized. The Mc Master numbering cell is quickly filled by using a Pasteur pipette. Then you have to let it sit for 5 minutes and count the eggs in two bedrooms (Troncy *et al*., 1991).

Milk production

Each 15 days, very early in the morning (around 06:00), milk was extracted by the herdsman in each herd.

Milk quantity per lactation was estimated by averaging the two monthly milking which was multiplied by the number of days of each month; this gave the monthly quantity of milk. The sum of different monthly quantity of milk over the duration of lactation yields an estimate of the quantity of milk per lactation extracted for human consumption.

All operations performed on animals in the absence of the investigator were recorded on a notebook. Indeed, health treatments, births, deaths and their causes, sales of animals and weaning dates were recorded.

Records concern 43 lactations in Sissédougou and 53 lactations in Nondara for N'Dama cattle. For Méré cattle 75 lactations were recorded in Nondara, 38 lactations in Landioudougou, 30 lactations in Ponondougou and 45 lactations in Sissédougou. There were 127 lactations for Métis cattle collected in Kantara locality.

Calving interval

This parameter is the period between two successive calving. For N’Dama cattle, the sample size was about 98 calving intervals distributed as follow: 45 observations in Nondara and 60 observations in Sissédougou. For Méré cattle, there were 362 records; 144 in Nondara, 73 in Landiougou, 58 in Ponondougou and 86 in Sissédougou. There were 202 calving intervals for Métis cattle.

Duration of lactation

Lactation length is the time elapsed from the beginning to the end of this lactation. This parameter was calculated in 80 cases in N’Dama breed, 190 in Méré cattle and 127 in Métis cattle.

Analysis of data

Data sheets were drawn on the basis of the regularity of their records, and then entered on coded data records before being stored on a database program.

Data verification was performed to find and fix or remove outliers, referring to the field sheets. These steps followed the calculations of different parameters.

Missing data were estimated by taking the value for the month in which the data was missed, the average of milk quantity of the two months that frame this missing data. This estimation does not take into account the lactations with missing data located at the beginning or end of lactation. Lactations with more than two missing data were not considered in our analysis.

The effects of genetic type, calving season, age, disease, on quantity of milk, and duration of lactation were investigated.

Age was used instead of number of lactation that was not possible to specify, because of the lack of information at this level. Age was divided into three levels: cows under 6 years, from 6 to 8 years, and those over 8 years.

Four (4) calving seasons were identified. (i) The beginning of dry season (from October to December); (ii) the middle and the end of dry season (from January to March); (iii) the beginning of rainy season (April-June); (iv) the middle and the end of the rainy season (from July to September).

Analysis of variance (ANOVA) was used. The effect of disease on milk production and duration of lactation was evaluated with Student test.

Analyzes were performed using SAS (Statistical Analysis System) software, 9.2 versions.

RESULTS

Prevalence of some diseases in the study area

Blood diseases

The overall prevalence of trypanosomiasis was 5.22 %. Three types of trypanosomes were met in the study area; *Trypanosoma congolense* (32.02 %), *Trypanosoma vivax* (47.14 %) and *Tryapanosoma brucei* (20.84%). The season influenced significantly (P <0.05) the prevalence of trypanosomiasis. Indeed, the dry season had the highest prevalence (5.92 %). The effect of locality was also significant (P <0.05) on the prevalence of this disease (Table 1).

Table 1: distribution of prevalence of blood diseases according to locality and season

Variable	Trypanosomiasis	Microfilariosis	Theileriosis
Locality	P = 0.007	P = 0.005	P = 0.223
Kantara	2.45^{bc}	6.96^{c}	30.59^{a}
Kouto	2.45^{bc}	14.14^{b}	34.71^{a}
Landiougou	1.24^{c}	14.34^{b}	36.78^{a}
Ponondougou	9.94^{a}	25.63^{a}	36.85^{a}
Nondara	5.62^{b}	13.83^{b}	34.82^{a}
Sissédougou	4.59^{bc}	10.99^{b}	35.28^{a}
Season	P = 0.031	P = 0.018	P = 0.042
Dry season	5.92^{a}	13.14^{b}	35.9^{a}
Rainy season	4.54^{b}	15.26^{a}	32.89^{b}

In each column the means with the same letter are not signicantly different at α=0.05

The prevalence of microfilariosis was significantly different (P <0.05) from a locality to another. The season also had a significant effect (P <0.05) on the prevalence of this disease. The rainy season is very favorable to this disease. However, for theileriosis, it is the dry season which is very favorable to the disease (Table 1).

Babesiosis and anaplasmosis are very rare diseases in the region. Indeed, over the period of this study, there were only two cases of animals carrying *Babesia spp*. and not of animals hosting *Anaplasma spp*.

Gastrointestinal diseases

The rainy season is very crucial for gastrointestinal diseases, especially for strongylosis, coccidiosis and fascioliasis (P <0.05). However, the effect of season on Strongyloidiasis was not significant (P <0.05). The effect of locality is highly significant (P <0.001) for ascariasis and significant for fascioliasis (P <0.05) (Table 2).

Table 2: Distribution of prevalence of gastrointestinal diseases according to locality and season

Variable	Strongylosis	Strongyloidiasis	Ascariasis	Coccidiosis	Fascioliasis
Locality	P = 0. 304	P = 0.102	P = 0.004	P = 0.218	P = 0.036
Kantara	43.14[a]	13.77[a]	32.38[a]	32.38[a]	10.13[a]
Kouto	49.27[a]	5.70[a]	1.91[b]	32.57[a]	5.29[b]
Landiougou	44.15[a]	9.04[a]	2.09[b]	39.19[a]	1.81[b]
Ponondougou	41.90[a]	3.04[a]	29.12[a]	29.12[a]	14.36[a]
Nondara	44.49[a]	4.78[a]	0.78[b]	34.04[a]	10.37[a]
Sissédougou	35.69[a]	5.19[a]	30.95[a]	30.95[a]	3.72[b]
Season	P = 0.004	P = 0.315	P = 0.006	P = 0.004	P = 0.027
Dry season	36.29[b]	4.90[a]	11.95[b]	27.10[b]	6.92[b]
Rainy season	48.82[a]	7.14[a]	20.11[a]	37.14[a]	11.56[a]

In each column the means with the same letter are not signicantly different at α=0.05

Milk production

The effect of breed on milk production was significant. Indeed, milk quantity produced by Métis cattle, 262±77 kg was significantly higher than those of the two other cattle. On another hand, Méré cattle with 223.3±64 kg of milk, was significantly different from N'Dama breed (193.53±46.76 kg). The analysis of the evolution of milk production within a monthly lactation showed that daily milk quantity of Métis cattle was significantly higher than quantities of milk produced daily by Méré cattle and N'Dama breed (Figure 1).

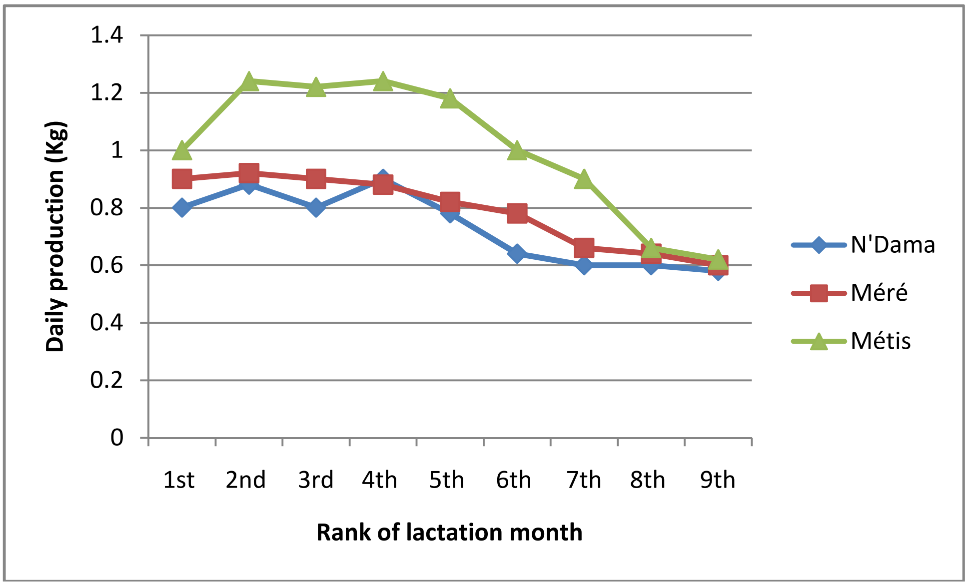

Figure1: Evolution of daily milk production according to genetic type

The effect of age on milk production was not significant in Méré and Métis cattle. However, age had a significant effect in N'Dama. The milk quantity produced by cows aged from 6 to 8 years, was significantly the highest; 211.3±72 kg.

They were followed by animals aged from 2 to 6 years with 184.7±53 kg of milk produced. The last group was composed of animals of age greater than 8 years (161.9 ±47 kg). Beyond 8 years, the quantity of milk declined.

The effect of calving season was significant in Metis cattle. But it was not significant in N'Dama breed and Méré cattle. In Métis cattle, calving beginning in the rainy season (from April to June), corresponded to the highest lactations (Figure 2).

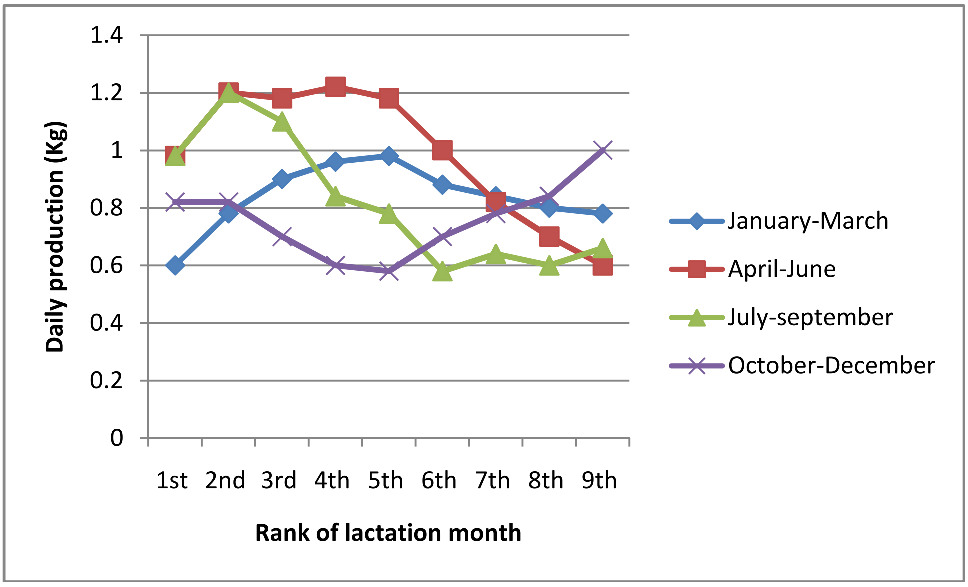

Figure 2 : Evolution of daily milk production according to calving season

The available data showed that theileriosis and microfilariosis had no significant effect on the total quantity of milk per lactation. Indeed, milk production from animals of which the test for these diseases were positive, was not significantly different from the quantity of milk from the other animals (Table 3).

Table 3: Effect of disisease (microfilariosis and theileriosis) on total lactaion

Breed	Healthy animals		Diseased animals		t observed	t excepted
	Lactation (kg)	Nbr	Lactation (kg)	Nbr		
N'Dama	138.79±17.74	2	210.19±48.03	9	1.873 ns	2.262
Méré	217.84±22.54	3	240.35±56.44	9	0.614 ns	2.228
Métis	258.86±22.87	7	257±68.88	11	0.0725 ns	2.179

Lactation: quantity of milk; Nbr: Number of animals; ns: Not significant; t: Student test; α=5%

Duration of lactation

Métis cattle had lactation length (310±53 days) significantly more important than duration of lactation from Méré catlle and N'Dama breed. In addition the lactation of Méré (290±38 days) cattle was significantly longer than the N'Dama one (277±28 days).
The effect of cow age on lactation length was not significant. There was nevertheless an observed trend. It showed that the duration of lactation decreased with age (Table 4).

Table 4: Effects of calving season and age on lactation length (days) in each genetic type

Calving season	N'Dama	Méré	Métis	Age (year)	N'Dama	Méré	Métis
Jan-March	272.5±48	285±48	296±35[b]	< 6	268±36	287±41	309± 42
April-June	280±42	293±47	322±39[a]	6<Age<8	266±23	280±38	296±36
July-Sept	273±45	289±52	310±46[a]	> 8	270±40	289±45	287±32
Oct-Dec	271.5±36	288±50	285±33[c]	-	-	-	-

In each column the means with the same letter are not signicantly different at α=0.05

The calving season had no significant effect on the duration of lactation in Méré cattle and N'Dama breed. However, its effect was significant in Métis cattle. The calving occurring between April and June recorded the longest lactation (314±39 days), followed by the period from July to September (311±46 days). The dry season recorded shorter lactations (Table 4).

As for milk, effect of disease was not significant over the period of lactation (Table 5).

Table 5: Effect of disisease (microfilariosis and theileriosis) on duration of lactaion

Breed	Healthy animals		Diseased animals		t observed	T excepted (5%)
	DL (day)	Nbr	DL (day)	Nbr		
N'Dama	259±22	2	271±24	9	1.620 ns	2.262
Méré	294±15	3	268±23	9	1.665 ns	2.228
Métis	312.5±15	7	307.5±36	11	1.719 ns	2.179

DL: Duration of lactation; Nbr: Number of animals; ns: Not significant; t: Student test; α=5%

Calving interval

The effect of Genetic type on this parameter was not significant. Calving intervals from N'Dama breed (495±132 days), Méré cattle (482±136 days) and Métis cattle (495±135 days) were not significantly different.

The cow age had no significant effect on calving interval. However in each the three genetic types studied, there was a trend showing that intervals were reduced with advancing age (Table 6).

Table 6: Effect of age on calving interval (days) in each genetic type

Age (year)	N'Dama	Méré	Métis
< 6	503±134	487.5±128	497±140
6<Age<8	489±159	475±120	486.5±126
>8	473±125	462±143.5	470±119.5

DISCUSSION

Méré cattle are better than N'Dama breed in perspective of milk production. This clearly shows the contribution of the cross on the genetic potential of animals (Gbodjo *et al.*, 2013). Indeed, it has already been shown that dairy performances of N'Dama breed are better than those of Baoulé breed (Coulomb, 1977). However, with input from crossing, the trend is reversed because Méré cattle (crossbreed from zebu and Baoulé) benefit from genetic potential provided by zebu to outperform the N'Dama breed. Therefore, the superiority of Métis cattle suggests that they are from crossing between zebu and N'Dama breed. In effect, in local breeds, for milk production N'Dama breed is superior to Baoulé one. Moreover, milk production of zebu breeds is significantly than those of these local breeds (Sokouri, 2008). Indeed milk production of Métis cattle was significantly higher than the N'Dama and Méré's ones. But this dairy performance is very lower than those of crossbred from N'Damance and N'Dama, 1024.4±468 kg (Gbodjo *et al.*, 2013).

The increase lactation with age before 8 years demonstrates a progressive establishment of milk production process. On the other hand, reducing lactation beyond 8 years reveals the negative impact of aging on dairy performance.

The calving season had a significant effect on milk production as indicated by Laoudi *et al*. (2011). The beginning of the rainy season was a favorable period of parturition for good milk production. In fact, cows that calve during this period have an abundant and lush pasture due to the rains return. The period from July to September is the second good season. At this level the right time are short (the end of rainy season). Animals will approach the dry season in difficult supply conditions. This food stress causes a decrease in milk production (Choisis *et al*., 1990; Mouffok and Madani, 2005; Laoudi *et al*. 2011). This result demonstrates that food and water availability are fundamental in milk production. At a few months from calving, energetic needs of cows increase, so they expend a lot of energy in this period of their gestation (Biggadike *et al*., 2001; Enjalbert, 2003; Faverdin *et al*., 2007).

Our data suggest the lack of significant effect of theileriosis and microfilariosis on total lactation. This could be explained by the limited data collected on disease parameter during our study. Indeed, several provisions were lacking during the data collection. First, there were very few sick cows that end their lactation, due to the fact that the herdsman stopped milking sick animals for three reasons: (i) to avoid depleting the cows, (ii) devote all milk to the calves, (iii) finally by health concern. This approach is certainly reasonable, but it skewed the results. In addition, when animal was positive for a disease it was automatically kept; that neutralized the action of the disease we wanted to highlight. Also, animals subjected to analysis generally had a benign pathology, so there was a small share of diseases. Milk remains an important source of income for the herdsman. Therefore cows are generally treated in case of illness.

In addition, the prevalence of trypanosomiasis in animals followed in this study was low, which showed that animals were treated. This result is not an isolated case. Analyses by CIPEA (1992) in Gambia in similar conditions showed that the effect of trypanosomiasis is low on milk production (non-significant effect of the disease on the total lactation). The fact that the PVC does not have an effect on lactation is certainly due to the same reasons.

Local breeds are recognized to be low milk producers. In the government ranch of Nioronigué in Ivory Coast, N'Damance cattle (crossbreed from Montbéliarde and N'Dama) produced an average of 5.5 kg/day of milk. The milk production of N'Dama breed was only 2.25 kg/day (Coulomb, 1977). For technical constraints, the results showed that a cow produces average 0.698 kg /day of milk in N'Dama breed.

The improvement of the mode of management (adequate veterinary care, nutritional supplementation, etc.) can significantly contribute to the improvement of milk production. Indeed, it has been shown that there is an interaction between genetic potential and production system (Kolver *et al*., 2002; Buckley *et al*.; 2005; Horan *et al*., 2005; Mc Carthy *et al*., 2007).

The duration of lactation obtained in this study for N'Dama breed (277±28 days) is much shorter than that obtained in Gambia during 411 days (Agyemang, 1987). This difference might be attributable to the herdsmen. In this study they stopped milking around 9 and 10 months to allow sufficient rest to the cows before their next parturition. This short duration of lactation is offset by a shorter calving interval.

In addition, Métis and Méré cattle have generally duration of lactation longer than N'Dama cattle. This advantage could be explained by the contribution of the cross breeds on the genetic potential of local breeds.

The rainy season records longer lactations because the abundance of grazing at this time helps maintain lactation for a longer time (Mc Carthy, 2007).

Regards to the total milk production, the effect of diseases on the duration of lactation was not significant. Similar conclusion was led by Agyemang (1987) in Gambia, who showed that trypanosomiasis had no significant effect on either the duration of lactation or on the total lactation.

There was a correlation between milk production and calving interval. In fact, animals that achieve high lactation had a longer calving interval. It might be that the herdsmen watching a long rest after heavy productions. Similar results were found in Gambia (Agyemang, 1987).

The average calving interval obtained in the present study in N'Dama breed is lower than that obtained in Gambia (604±160 days) by Agyemang *et al*., (1987). However this average is higher than that obtained in research station in Bouaké, Côte d'Ivoire (Sokouri *et al*. 2010) and in Congo (428 days), (Akouango *et al*. 2010).

CONCLUSION

The results of this study showed that dairy performances of livestock in rural areas are low. The reasons are to be found at the genetic and technical constraints. So the genetic potential expression of local breeds is low due to inadequate natural and technical environment. We believe that in creating improved management conditions, the performance of local breeds could be enounced. So, herd owners should not consider livestock as a marginal activity but rather as a real business. Nutritional and mineral supplementation must be promoted, and hay must be stored to prevent food shortages during the dry season.

REFERENCE

Agyemang, K., P. Jennin, M.L. Grive, and R.H. Dwinger. 1987. Production laitière destinée à la consommation humaine des bovins N'Dama dans un système d'élevage villageois en Gambie. In: *Production animale dans les régions d'Afrique infestées par les glossines*. Compte rendu de Réunion, 23-27 Novembre 1987 Nairobi Kenya. Réseau Africain d'Etude du Bétail trypanotolérant. ILCA Nairobi 1988. 259-276.

Akouango, F., C. Ngokaka, P. Ewomango, and E. Kimbembe. 2010. Caractérisation morphométrique et reproductive des taureaux et vaches N'Dama du Congo. *Animal Genetic Ressources*. 46: 41-47.

Atsé, A.P. and Z.L. Gbodjo. 1998. Rapport annuel du Projet National d'Appui au Développement Laitier (ex-Projet Bovin Industriel). Korhogo, Ivory Coast. 25p. Biggadike H., Laven R. and Bull R. 2001. Economic feeding for high fertility. Milk Development Council. Projet: No.99/T2/17. p. 39.

Buckley, F., C. Holmes, and M.G. Keane. 2005. Genetic characteristics required in dairy and beef cattle for temperate grazing systems. *Proc. Satellite workshop of the XXth Intern*. Grassland Congress «Utilsation of grazed grass in temperate animal systems». Cork, Ireland. 61-78.

Choisis, J.P., N. Cervantes, and P. Lhoste. 1990. Effets saisonniers sur certains paramètres de la production bovine dans les élevages mixtes de l'état de Colima au Mexique. *Revue d'élevage et de médecine vétérinaire des pays tropicaux*. 43:97-104.

CIPEA. 1992. Rapport annuel et synthèse des programmes. Centre international pour l'élevage en Afrique. Addis-Abeba, Ethiopia. p. 175.

Coulomb, J., J. Gruvel, P. Morel, P. Perreau, R. Queval, and R. Tibayrence. 1977. La trypanotolérance. Synthèse des connaissances actuelles. Paris, Ministère de la coopération, Maisons-Alfort, I.E.M.V.T. p. 365.

Enjalbert, F. 2003. Alimentation de la vache laitière, les contraintes nutritionnelles autour du vêlage. *Le Point Vétérinaire*. 236:40-44.

Faverdin, P., R. Delagarde, L. Delaby, and F. Meschy. 2007. Alimentation des vaches laitières. *INRA*, alimentation des bovins, ovins et caprins, Ed Quae, Paris : 23-55.

Gbodjo, Z.L., D.P. Sokouri, K.E. N'Goran, and B. Soro. 2013. Performances de reproduction et production laitière de bovins hybrides élevés dans des fermes du «Projet Laitier Sud » en Côte d'Ivoire. *Journal of Animal and Plant Sciences*. 19: 2948-2960.

Horan, B., P. Dillon, P. Faverdin, L. Delaby, F. Buckley, and M. Rath. 2005. The interaction of strain of Holstein-Friesain cows and pasture-based feed systems on milk yield, body weight and body condition score. *J. Dairy Sci*. 88: 1231-1243.

Kolver, E.S., J.R. Roche, M.J. De Veth, P.L. Thorne, and A.R. Napper. 2002. Total mixed rations versus pasture diets: Evidence for a genotype x diet interaction in dairy cow performance. *Proc. New Zealand Soc. of Animal Prod*. 62: 246-251.

Laouadi, M., S. Tennah, S. Bouzerd, and T. Madani. 2011. Relation Entre l'état Corporel et la Production Laitière dans un élevage bovin au nord algérien. *European Journal of Scientific Research*. 58(4): 570-581.

Mc Carthy, S., B. Horan, M. Rath, M. Linnane, O'Connor and P. Dillon. 2007. The influence of strain of Holstein-Friesain dairy cow and pasture-based feeding system on grazing behaviour, intake and milck production. *Grass and Forage Science*. 62: 13-26.

Mouffo, k.C. and T. Madani. 2005. Effet de la saison de vêlage sur la production laitière de la Race Montbéliarde sous conditions semi-arides algériennes. Rencontres. Recherches. Ruminants. p. 205.

MPARH. 2012. Annuaire des statistiques des ressources animales et halieutiques. Direction de la Planification et des Programmes. Ministère des Productions Animales et des Ressources Halieutiques. Ivory Coast. p. 13.

Rege, J.E.O., G.S. Aboagye, and C.L. Tawah. 1994. Shorthorn cattle in West and CentraiAfrica. *World Anim. Rev*. 78: 42-49.

Sokouri, D.P., N.E. Loukou, C.V. Yapi-Gnaoré, J. Mondeil. and F. Gnangbé. 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.

Sokouri, D.P., C.V. Yapi-Gnaoré, A.S.P. N'Guetta, N.E. Loukou, B.J. Kouao, G. Touré, A. Kouassi, and A. Sangaré. 2010. Performances de reproduction des races bovines locales de Côte d'Ivoire. *J. Appl. Biosci*. 36: 2353-2359.

Troncy P.M., J. Itard and P.C. Model 1991. Précis de parasitologie vétérinaire tropicale. Ministère de la coopération et du développement. République française. p. 717.