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Original Article

Nikki's and Pehunco's Stock Farmers Technical Knowledge Effects on Herds of Cattle's Productivity in North of Benin

[*1]Soule A. H., [2]Djenontin J. A. P., [1]Babatounde S., [2]Traore I. A., [3]Koudande D. O., [4]Farougou S. and [3]Mensah G. A.

[1] Laboratoire de Zootechnie. Faculté des Sciences Agronomiques. Université d'Abomey-Calavi. Benin Republic.
[2] Laboratoire de Production Animale et Halieutique. Université de Parakou, Benin Republic.
[3] Centre de Recherches Agricoles d'Agonkanmey. Institut National des Recherches Agricoles du Bénin. Benin Republic.
[4] Ecole Polytechnique d'Abomey-Calavi, Université d'Abomey-Calavi. Benin Republic.

Abstract

This study aimed to determine herds of cattle's productivities which supplied diary in Nikki's and Pehunco's districts characterized in previous works. Four types of cattle-breeders called CB1, CB2, CB3 and CB4, differentiated by ethnicity, farming - cattle breeding integration, family's skilled labor level, breeders' training level, cattle phenotype, endogenous health knowledge, prophylaxis practice and food supplementation with crop residues have been identified. Livestock productivity survey method was used. The General Linear Model applied to survey results show those cattle breeders' training and cattle's phenotype influence productivity. Training cattle breeders (CB3) have cattle with better phenotype and have highest productivity ($p<0.05$). The order zootechnical parameters were influenced by those two characteristics ($p<0.05$). Hybrid Borgou-Gudali'phenotype allows breeders to improve their exploitation rate. Training breeders have oriented their production on milk in the goal to supply the districts' diaries. Training enhances cattle production. Milk development projects must focus their actions on breeders training in the goal to supply diaries in fresh milk. CB2's cattle herds are ones which allow livestock development productivity projects.

Keywords: Training breeders, cattle's phenotype, productivity, Benin.

[*] Corresponding author: Laboratoire de Zootechnie. Faculté des Sciences Agronomiques. Université d'Abomey-Calavi. Benin Republic.
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Introduction

Benin's herd cattle rise up to 2.058 million head in 2011 (FAO, 2013) and is composed of trypanotolerant bulls (Borgou, Somba and Lagunaire), zebu (M'bororo, Djelli, Goudali and White Fulani) and hybrids from their crosses (Djenontin *et al.*, 2004). The cattle population is concentrated in the north of the country. Nikki's and Pehunco's districts located in Borgou and Atacora department respectively have 9.02% of national herd in 2011 (FAO, 2013). Many livestock development projects have been executed there with focused in breeders training (Soule *et al.*, 2014). In Benin, milk production level is weakened by an extensive traditional farming system whose productivity is very low and does not reach the degree of efficiency required to meet the needs of a growing population (Dehoux and Hounsou - Ve, 1993). Zootechnical diagnosis of cattle farms in two districts was carried out to assess their dairy potential. This typology made in previous study has identified four types of cattle - breeders called CB1, CB2, CB3 and CB4. The CB1's breeders war 13% of total and they are Agro – Pastoralists they were illiterate cattle-breeders but their Borgou cattle received crop residues and veterinary or endogenous care. The CB2's breeders are 1% of total and they are Great Agro - Pastoralists They were illiterate farmers with crossbreed cattle Borgou X Somba, and Borgou X Zebu receiving crop residues and combined endogenous and veterinary care treatments. The CB3's breeders are 71% of total and they are Small Agro – Pastoralists with a very weak integration of farming and cattle breeding. They were literate breeders and trained in production techniques with Goudali cattle which received crop residues and combined endogenous and veterinary treatments. The CB4's breeders are 15% of total and they are Middle Agro - Pastoralists These breeders are provided with schooling, literate and trained in livestock production techniques. They had Borgou cattle which received crop residues and endogenous and veterinary treatments (Soule *et al.*, 2014). This study has been done to show breeders' training level and cattle's phenotype on milk production.

Methodology

Study Area

The study was conducted in Nikki's and Péhunco's cattle farms. Nikki was located in the Departments of Borgou in the north – east of Benin Republic. Péhunco was located in the department of Atacora in the north – west of Benin Republic.

The city of Péhunco is located between 10°13'42" north latitude and 2°0'7" east longitude Its total area is 1,900 km² (INSAE, 2003). The city of Nikki is located between meridians 9°56'00" north latitude and 3°12'30" east longitude. The two districts climate is Sudano - Guinean marked by a rainy season from May to October and a dry season from November to April. The average annual rainfall over a period of ten years is 1051 ± 212 mm. The annual average temperature and relative humidity during the same period were respectively 28.2 ± 0.6°C and 56.4 ± 1.9% (Soule *et al.*, 2014).

Survey Methodology

The semi -structured and structured interviews with farmers individually or in the same group was adapted from August to December 2011. The family is seen as a group of individuals who live together and eat together (Jouve, 1986; Sraïri, 2004). The method of livestock productivity survey developed by IEMVT and CIRAD, adapted to the realities and constraints of our work was used for this study. It has been used for the typology of cattle farms in many countries including Guinea (Lhoste *et al.*, 1993) and Benin (Alkoiret *et al.*, 2009).

The questions concerned the breeder (location, lumber used socio-cultural group, age, level of education and literacy, family size, area planted, hand, point of sale of fresh milk), animals (number of cattle, sheep, goats and poultry, phenotype and origin of animals) and farming practices (type of farming and breeding, health monitoring and food and mineral supplementation). A random sample of 146 breeders at Nikki totalizing 9,306 cattle head (16.7 % of Nikki's cattle herd) was made in the base extension services list. At Pehunco too, a random sample of 139 breeders with 10,431 cattle head (8.2% of Pehunco's cattle herd) was made.

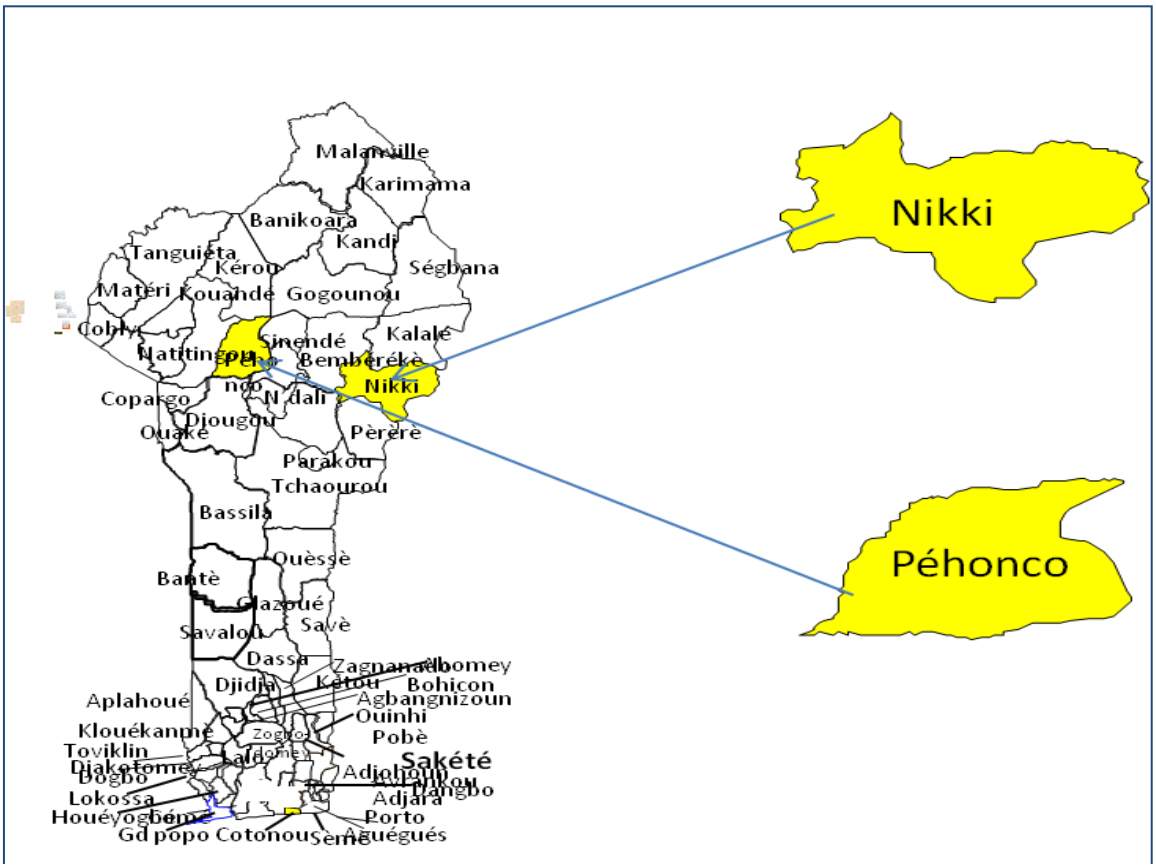

Fig. 1: Districts covered by the survey on cattle farms in the study area in northern Benin.

Herds surveyed were selected from four types of pastoralists and agro - pastoralists called CB1, CB2, CB3 and CB4 (Soule *et al.*, 2014).

CB1 (13%): These are agro-pastoralists who have large cattle herds between 75 and 150 heads, snow with average areas of 3.5 to 7 ha and showing a strong integration of farming with high use of family skilled labor and a large population of small ruminants from 30 to 80 head. They were non training cattle-breeders but their Borgou cattle received crop residues and veterinary or endogenous care.

CB 2 (1%): These are Great Agro -pastoralists who have both wholes beef cattle (over 500 head) and small ruminants (over 150 head) that snow with crop large areas more than 10 ha and showed strong integration of faring with breedin, with low use of family skilled labor. They were non training farmers with crossbreed cattle Borgou X Somba, and Borgou X Zebu receiving crop residues and combined endogenous and veterinary care treatments.

CB 3 (71%): These are Small Agro – pastoralists who have a minimum beef cattle (20 to 100 heads) and small ruminants population (10-20 heads) with minimum area snow with crop of 0.5 to 2,50 ha. This indicates a very weak integration of farming and cattle breeding. They were training breeders and trained in production techniques with Goudali cattle which received crop residues and combined endogenous and veterinary treatments.

CB 4 (15%): These are Middle Agro-pastoralists who have medium cattle herds (75 to 150 heads) and small ruminants population (20-50 heads) and snow with crops small areas (2 to 3 ha) which showed farming and breeding integration with a strong use of family skilled labor. These breeders are provided with schooling and trained in livestock production techniques. They had Borgou cattle which received crop residues and endogenous and veterinary treatments.

Statistical Analysis

Analysis of variance was performed with the GLM procedure performed in MINITAB 16 and enabled to see factors' effects (training and bovine phenotype).

Averages have been organizes in a hierarchy with Dunnet test and confirmed by Borrofonni test.

Results

Demographic Parameters

Rate calculated (Tables 1 and 2) showed that breeding male's number ratio animals compared to females are significantly different ($p<0.05$) by type of cattle farming. This ratio were lower in CB1 and CB2 herds (49 and 18%) which breeders were trained and highest in CB3 and CB4 herds (66 and 34.27 %) which breeders weren't trained.

Table 1: Parameters calculations Lhotse *et al.,* (1993).

Parameters	Formulas calculus
Reproductive parameters	Apparent Fertility Rate (APR) = Number of gestation * 100 / Breeding females
	Abortion Rate (AR) = Number of abortion * 100 / Breeding females
	Birth rate (BR) = Number of calving * 100 / Breeding females
	Fertility rate (FR) = live births animals * 100 / Breeding females
	Weaning productivity (APr) = Live weaned animals * 100/ Breeding females
Mortality parameters	Fetal death rate (FDR) = number of fetal deaths * 100 / Live Borned Animals
	Perinatal mortality rate (PeMR) = (fetal deaths + deaths between 0 and 15 days) * 100/ Live Borned Animals
	Pre weaning mortality rate (PrWMR)= Animals died before weaning * 100 / Live Borned Animals
	General mortality rate (GMR) = Number of deaths * 100 / {(final Number - Initial Number)/2}
Exploitations Parameters	Exploitation Rate (ER) = Number of animals used * 100 / {(Final Number - Initial Number)/2}
	Growth Rate (GR) = (Final Number - Initial Number) * 100 / {(Final Number - Initial Number)/2}
	Net Growth Rate (NGR) = GR – (Immigrants * 100 / {(Final Number - Initial Number)/2})
	Herd Efficiency (HE) = ER + NGR

Table 2 : Demographic Parameters.

Animals	Breeders trained		Breeders non trained	
	CB1	CB2	CB3	CB4
	Borgou Phenotype	Hybrid Borgou and Goudali phemotype	Borgou phenotype	Hybrid Borgou and Goudali Phenotype
Females				
Female calf	8.16±3.21 [a]	8±3.37 [a]	11.26±4.57 [b]	30.66±37.52 [c]
Heifers	5.3±3.10 [a]	5.75±2.61 [a]	10.47±3.95 [b]	16.50±12.16 [c]
Cows	30±13.63 [a]	28.38±14.17 [a]	33.78±8.91 [a]	85.75±87.65 [b]
Total females	49±17.94 [a]	47±21.39 [a]	66±14.17 [b]	149.41±141 [c]
Males				
Calf	7.08±2.77 [a]	4±3.03 [a]	7.65±3.50 [a]	20.83±28.57 [b]
Bull 1st age	5.45±2.70 [a]	4.5±2.9 [a]	11.91±5.87 [b]	27.95±44.08 [c]
Bulls	2.41±2.15 [a]	1.5±2.22 [a]	4.17±0.93 [b]	6±4.78 [b]
Total males	18±7.57 [a]	10.5±8.64 [b]	34.26±12.31 [c]	78.25±115.68 [d]
Average Number	67.5±23.82 [a]	57.5±28.36 [a]	100.26±25.84 [b]	227.66±252.18 [c]

[a, b, c, d]: the values on the same line with different letters are significantly different at 5% ($p<0.05$).

Reproductive Parameters

Reproductive parameters calculated were in the Table 3.

Table 3: Reproductive Parameters.

Animals	Breeders trained		Breeders non trained	
	CB1	CB2	CB3	CB4
	Borgou Phenotype	Hybrid Borgou and Goudali phenotype	Borgou phenotype	Hybrid Borgou and Goudali Phenotype
ER	1,9 ±1,6 [a]	0 [b]	1,8 ±1,4 [a]	1,9 ±1,1 [a]
APR	53,5 ±8,3 [a]	43,98 ±13,72 [a]	70,5 ±17,6 [b]	69,4 ±15,5 [b]
GR	2,6 ±1,8 [a]	17,69 ±6,31 [b]	2,9 ±1,3 [a]	3,2 ±1,5 [c]
PrWMR	29,8 ±18,1 [a]	19,44 ±16,60 [b]	23,3 ±11,1 [c]	21,6 ±11,0 [c]
GMR	2,7 ±1,6 [a]	1,78 ±1,59 [b]	2,6 ±1,0 [a]	2,6 ±1,1 [a]

[a, b, c, d]: the values on the same line with different letters are significantly different at 5% ($p < 0.05$).

Rates

GLM analysis showed that the best trained breeders had the highest apparent fertility rates (AFR) (68.8%, for trained breeders against 49.4 % for non-trained, $p < 0.0001$). Moreover bovine phenotype had an effect on the APR. Indeed, hybrid Goudali and Borgou bovine had highest APR than Borgou bovine (62.2% vs 55.9 %, $p< 0.0001$).

Those two factors also have an effect on different mortalities rates. Indeed, non-trained breeders had the highest GMR (2.7 ± 1.6% for non-trained against 2.6 ± 1.0% for trained, $p<0.05$). Borgou bovine's mortality rate (TMG) were highest than hybrid Borgou-Gudali (2.6 ± 1.1% vs 1.78%, $p < 0.05$).

Likewise, exploitation rate (ER) was influenced by training and cattle's phenotype. The hybrid Borgou and Gudali cattle gave more exploitation possibilities to the breeders than Borgou cattle. Indeed the ER of cattle farms which bred with hybrid Borgou and Gudali cattle was 5.9% and was highest than the 3.2% of cattle farm which bred Borgou's cattle ($p<0.05$).

Discussion

Breeding system in Nikki's and Pehunco's districts which have a diary each have been studied through herds' demographic and reproductive parameters analysis. The results have showed that training factor have no influence on the ratio female/male ($p>0.05$) but have an effect on breeding female/male ratio ($p<0.05$). Indeed, this proportion depends mainly on breeders' reproduction management. This sex ratio is similar to that obtained by Alkoiret *et al.,* (2011), by Dehoux and Hounsou - Ve (1993) in Nikki's, Kalale's and Segbana's districts, by Alkoiret *et al.*, (2009) in Gogounou. At Gogounou's districts (Alkoiret *et al.,* 2010) the sex ratio male/female is around 40 %. Training breeders (CB1 and CB2) knew the importance of this sex ratio whereas non-training breeders have adopted to let free a breeding male in breeding female flock. This herds' demographic structure confirms the specialization of CB2 and CB4 cattle in milk production. In these cattle farms, breeders use Gudali and hybrid Gudali – Borgou to improve this milk production. As livestock are treated as rural bank and social and natural capital (McLeod and Wilsmore, 2001) their management must be enhanced by training. It's the reason why, training breeders have a better breeding female/male ration and have specialized their herd in milk production. Training importance has been underlined by rural women in Potohar plateau in Pakistan (Nosheen *et al.,* 2011). Indeed, it was revealed from this study that more frequently carried out activities by rural women were livestock management, animal production, protection and poultry husbandry. And they were interested to get their training in livestock management, animal production, protection, poultry husbandry and marketing of animals to boost up the livestock productivity. The training effect in livestock breeding also determine cattle phenotypes' choice

and influences significantly the apparent fertility rate ($p<0.05$), global mortality rate ($p<0.05$) and exploitation rate ($p < 0.05$). This's the same in in Reunion, France oversea department, where training also improves milk's production efficiency (D'Haese, 2009). Indeed, the farmers on the efficiency frontier had a relatively higher milk production, milk production per cow, and land surface than those who were less efficient (D'Haese, 2009). And in France, the lower global mortality rate were recorded by Holstein breeders who have Good Breeding Practices, i.e. having a calving peak in autumn, culling rate, and municipal cattle density. (Raboison *et al.*, 2011). This situation is allowed by the actions of several livestock development projects (DE, 2013) in our study and by the European Union's financial and technical support for breeders. The apparent fertility rate and exploitation rate obtained in our study is lower than those obtained by Youssao *et al.*, (2000) on Borgou cattle at Opkara ranch which are 78±8.4%. This difference is perhaps explained by breeding system which is modern at Okpara.

Conclusion

This study analyzes training and bovine's phenotype effects on demographic and reproductive parameters of four types of cattle farming in Nikki's and Pehunco's districts in North Benin. The most significant differences between the types of cattle reside in a lower mortality rate and a higher apparent fertility rate. Hybrid Borgou-Gudali'phenotype allows breeders to improve their exploitation rate. Training breeders have oriented their production on milk in the goal to supply the districts' diaries. Training enhances cattle production. Milk development projects must focus their actions on breeders training in the goal to supply diaries in fresh milk.

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