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The typology of the pig breeding in Burkina Faso: cases of the towns of Bobo-Dioulasso and Gaoua in soudanian area; Kaya and Dori in sahelian area

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Abstract

The study aimed to establish a typology of the pig breeding (breeding systems) of Burkina Faso. The analysis of data of a retrospective and transversal survey in 2008 done in 903 breedings in the towns of Bobo-Dioulasso, Dori, Gaoua and Kaya has allowed to indentify 3 types. A type A (1.77% of the total breedings), known as intensive is Characterized by an high investment, a pig flock of 107 heads, 01 paid employee, an average sale of 70 pigs/ year. The pigs which were in Permanent Close (PC) were very well fed and treated. The type B, known as semi-intensive was noticed in all the towns. The investment, the flock (14 heads) and the paid employees (0.37 as the average) were less important than in the type A. The pigs were in Permanent Close (in rainy season) and in Partial Close (in dry season). This type has sold fewer pigs than the type A. The type C known as extensive, observed in all the towns was the most frequent with an investment and a paid employee extremely low (0.01) of breeding without accommodations. The partial close even the ramblings were the way of keeping. This type has sold more pigs but got less takings than B. The feeding constraint was the most crucial in all the types of breeding. The reusing of the production waste and its transformation could be an alternative to cope with this constraint.

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Introduction

The diversity of the agricultural situations can be seen in two levels: At the region level where the physical elements are the causes of the noted differences and at the farm level where the elements of the structure and the working methods act. This heterogeneity was often mentioned as one of the main causes of failure of the development operations laying on some standardized outlines (Pierrot and Landais, 1993). Noting this fact, many players have taken into account the diversity of the agricultural situations as the fundamental conditions for the success of the interventions in the rural areas (Colson, 1985; MBetid-Bassanne and al. 2003; Kiendrebeogo and al. 2008). The agricultural productions include the vegetable cultures and the breeding. Among the animals, those which have a short cycle among them, pigs are the main used in order to satisfy the needs (nutritional, income, etc.). With an increasing demand of pig meat, we witness a renewed interest of the development of the pig production in West Africa (Porphyre, 2009). In Burkina Faso, pig breeding is a dominant activity with a considerable livestock estimated to be 2,210,565 pigs in 2011(MRA, 2012). It is also an omnipresent activity in all the regions of Burkina Faso (MED and MRA, 2004). In 2009, pig breeding represented 4.5% of the nominal value (1623.7billion FCFA) of the Burkina livestock. It had a potentional of creation of an added value per animal/family/year of 9750FCFA after the cattle (31,230FCFA) and ahead of the other main species grown which are sheep (4,020FCFA), goats(3,640FCFA)and poultry (470FCFA) (MRA,2011) . The supply with the consummate meat at the national level is 14% (including the meat of suides wild) and 10% for the meat supply in the town of Bobo-Dioulasso (Kiendrebeogo and al.,2012). The promotion and the development of the pig breeding, like the other species with a short cycle, are from now on the main line of intervention which would allow to increase quickly and substantially the quantities of the consummate meat. In that way, it had been planned on the horizon 2010 to create the favorable conditions for the disponibility and the availability of a sufficient and balanced food (2500kcal/person and per day) and to double the meat consumption and meat equivalent which is at the present time of 9.3kg/ (MRA, 2005)

To improve the contribution of the industry with the intension of reaching these results, the players need to have an overall and synthetic vision of the diversity of the methods and the similarity of the contraints which characterize the pig breeding in Burkina Faso. For that purpose, some surveys were done in the urban and peri-urban zones of the towns of Bobo-Dioulasso in the West, Gaoua in the South-West, Kaya in the nearby central plateau and Dori in the Sahel.

The aim was to draw up a typology of the pig breeding in order to allow the priority of the complementary actions to be gone further and in order to envisage some interventions ways for the development of the pig breeding.

Materials and methods

The study zone

The study was done in Bobo-Dioulasso, the main town of the region of the Haut-Bassin, in Gaoua in the South-West region, in Kaya in the Centre-North which is in the soudano-sahelian zone and in Dori in the Sahel region. All these towns are in Burkina Faso. Bobo-Dioulasso (489,957 inhabitants) is the 2nd main town of Burkina after the capital Ouagadougou (1,475,223 inhabitants). Kaya (54,435 inhabitants) and Gaoua (52,733 inhabitants) are the secondary towns. The concerned towns are located in the sahelian and soudanian zones (Fig. 1).

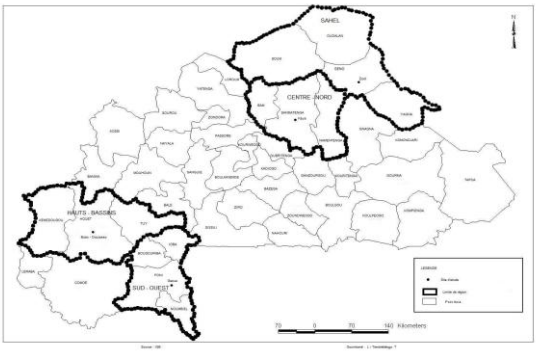

Fig. 1. Representation of the agro-ecological areas of the regions and towns where the survey was done.

The data/facts gathering

The data were gathered through a retrospective and transversal survey which was done in 2008 with 903 pig breeders in the urban and peri-urban zones of Bobo-Dioulasso, Gaoua, Kaya and Dori. The pieces of information gathered were about the structure of the production units (the space for the breeding, the social and demographic pieces of data, facilities and equipment), the method of the pig breeding (the keeping, feeding, health and the maintenance) and the performance (zootechnics and economic domains especially sales).

Data analysis

It was done into 3 stages following an approach already used by some authors (Hamadou *et al.*, 2004; Kiendrebeogo, 2006; Kiendrebeogo *et al.*, 2008; Drabo, 2011):

- A classification through the Analysis of the Main Component (AMC) has allowed to hold the variables of the classification;
- A classification through the method of K-means using the variables got in the AMC;
- The Discriminant Factorial Analysis (DFA) using a large number of variables in order to confirm the reached classes.

Some descriptive analyses and analyses of comparison inside the system (classes) and inside the localities were done next. Those analyses allowed to characterize the systems.

Results

The descriptive statistics of the analysis variables

The results of the descriptive statistics show some very important disparities between the extreme values and even some gap-types, linked to the heterogeneity of the gathered data. It is the case of HVAL, INST and EQVAL variables (Table1).

Table 1. Descriptive Statistics of the analysis variables.

Variable		*Obs.*	*Min*	*Max*	*Average*	*Ecartype*
INST	Education level of the RL(points)*	903	0	8.00	2.3	2.5
HVAL	the pig habitat Value(FCFA)	903	0	4, 000,000	111,687	342, 615
EQVAL	the hold equipment Value	903	0	4, 800,000	65,248	178 ,711
ACTIF	number of workers in a family	903	0	58.0	5.1	4.1
TRUIE	number of sows in a flock	903	0	50.0	2.5	3.0
MOSA	number of paid employees	903	0	10.0	0.1	0.4
TROUP	the total number of pig flock	903	1	264	15	17
ALIM	spending for food/day	903	0	6,000	373	559
CHARET	number of hold carts	903	0	3.0	0.4	0.6
BROUET	number of hold wheelbarrows	903	0	6.0	0.3	0.5

CE=Running Leader; Obs= Observations

* Primairy level=01point, Secondary1st stage=2points, Secondary 2nd Stage=3pints, university 1st Stage=4points, University 2nd and 3rd stages=5points and more.

Typology of the breeding

Two (2) factors F1 and F2 were drawn from the Discriminant Factorial Analysis (DFA). The Table 2 shows that except the EQVAL and the Flock variables, all the variables were positively correlated with the axis F1 whose explained variance was 85.61%. The axis F1 is the main axis of the habitat, food and the number of sows in the flock. The variables INST, TROUP, MOSA, BROUET and ACTIF were positively correlated with the axis F2 whose explained variance was 14.39% (Fig. 2). The other variables were negatively correlated. The axis F2 is the axis of the education and in a lesser measurement, the axis of the investment in equipment.

Table 2. The values of correlation between the variables and the factors of discrimination.

Variables	*F1*	*F2*
INST	0.334	1.374
HVAL	1.928	-0.489
EQVAL	-0.598	-0.157
ACTIF	0.000	0.000
TRUIE	1.645	-0.368
MOSA	0.262	0.412
TROUP	-1.384	1.188
ALIM	0.481	-0.736
CHARET	0.227	0.116
BROUET	0.357	-0.234

The DFA, rehearsed, has allowed the reassignment of the breeding from one type to another and it confirmed the three (3) types of breeding (by the names A, B and C) obtained during the results of the analysis by the K-Means. The results of the one-dimensional test about the averages of the types (Table 3) and the coordinates of the central individuals following the axis F1 and F2, the types A (5.87 ;-0.30), B(-2.31 ; 2.23) and C (-3.56 ;-1.94) have shown that the types of breeding made-up are significantly different ($p<0.05$).

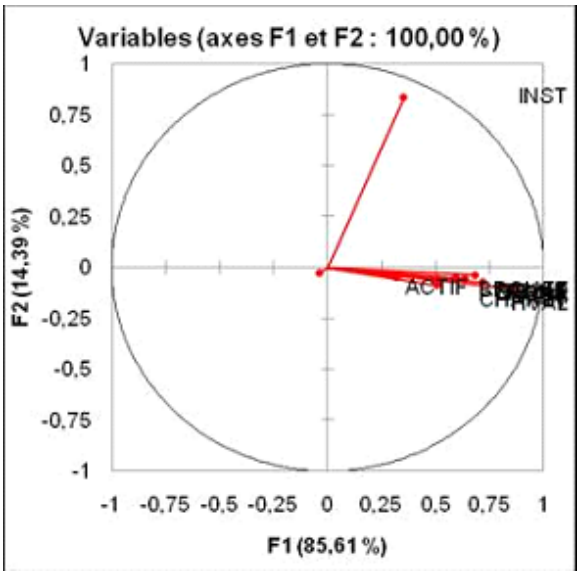

Fig. 2. Correlation between the variables and the classification factors.

Table 3. One-dimensional test of the equality averages ($p<0.05$) of the breeding types A, B and C in Buurkina Faso.

Variable	*Lambda*	*F*	*DDL1*	*DDL2*	*p-value*
INST	0.364	786.377	2	900	< 0.0001
HVAL	0.281	1153.613	2	900	< 0.0001
EQVAL	0.901	49.721	2	900	< 0.0001
ACTIF			2	900	
TRUIE	0.667	225.108	2	900	< 0.0001
MOSA	0.754	146.630	2	900	< 0.0001
TROUP	0.615	282.162	2	900	< 0.0001
ALIM	0.511	430.562	2	900	< 0.0001
CHARET	0.752	148.782	2	900	< 0.0001
BROUET	0.560	353.379	2	900	< 0.0001

The types of breeding are projected in the factorial space made-up by F1 and F2 (Fig. 3)

The Fig. 3 and Fig.4 show the allocation of the types of breeding per locality proportionately to the entire sample and the frequency of the types in each locality taken separately. The type A was the less frequent (1.77% of the whole breeding) and was especially noted in the localities of Bobo-Dioulasso and in a lesser measurement in Dori. In the localities taken separately, it was not important (3.04% of the breeding).

The type B was 36% more frequent than the type A and 20% less represented than the type C. It was almost missing in Kaya (1%) less important than the

type C in Bobo-Dioulasso and more represented than the latter in Gaoua. The type C was the most frequent in the whole sample in Bobo-Dioulasso and Kaya where it was nearly the only one.

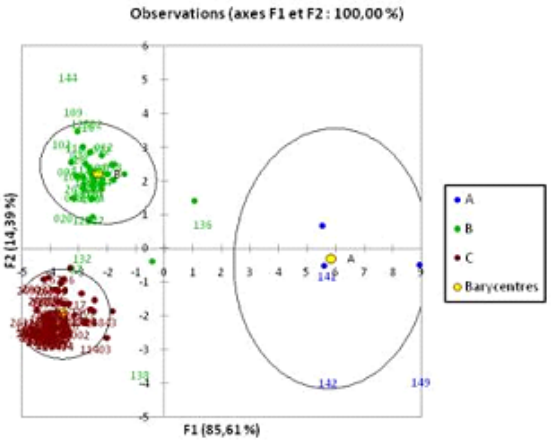

Fig. 3. Projection of the pig breedings of Burkina Faso per type in the discriminant vector space.

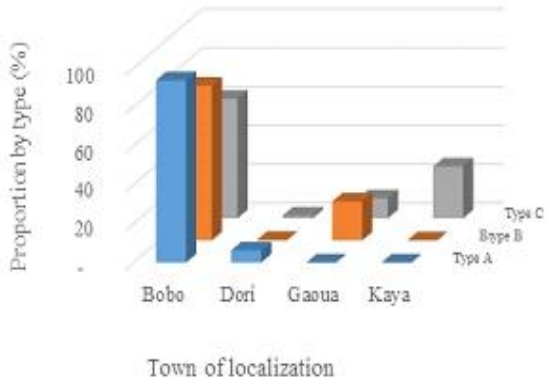

Fig. 4. Frequency(%) of the types per locality.

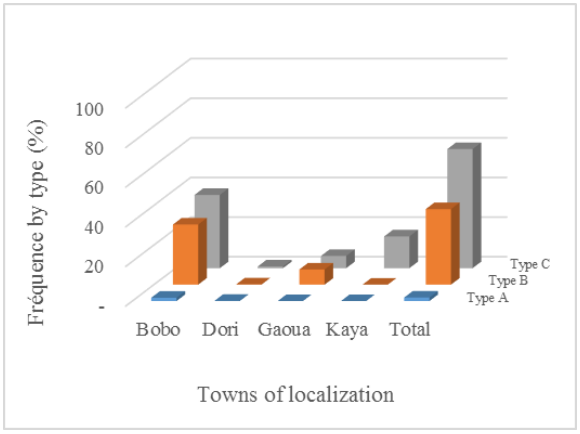

Fig. 5. Allocation of the breeding and the types in %in the investigated localities.

Characterization of the types of breeding socio-demographic Characteristics

In Bobo-Dioulasso, in the types B and C, the breedings have an agricultural property of a very significant area more bigger than the other localities whatever the type (Table 4). The Running leader (RL) was older than in Gaoua for the type B and in Dori for the type C. The runnings of pig breeding were the oldest installations in the towns of Bobo-Dioulasso and Gaoua than in Kaya and Dori. The level of education of the running leader is significantly higher in Bobo-Dioulasso and Gaoua for the type B if compared to the other towns and types. The runnings have employed more employees in Dori for the type B, next in Bobo-Dioulasso for the types B and C than in the other localities and types.

Table 4. Structure of the running and the charactristic of the runnig leader,pig breeders in Burkina Faso.

Variables	***Type A***		***Type B***			***Type C***			
	Bobo	Dori	Bobo	Dori	Gaoua	Bobo	Dori	Gaoua	Kaya
Land property (ha)	2	0	4.1^{b}	2.5^{ab}	2.1^{a}	4.4^{a}	0^{a}	1.4^{a}	1^{a}
Age of the householder(year)	41	38	37^{a}	40^{ab}	50^{b}	43^{a}	63^{b}	41^{a}	41^{a}
Age of the breeding(year)	8		7^{a}	4^{a}	7^{a}	8^{a}	2^{a}	7^{a}	4^{a}
level of education*(points)	4	2	5^{c}	1^{a}	5^{b}	0.1^{a}	$1b^{c}$	1.1^{c}	0.4^{b}
Number of the workers in a house	4	17	5^{a}	2^{a}	5^{a}	6^{a}	4^{a}	6^{a}	5^{a}
Number of paid employees	2	0	0.1^{a}	1^{b}	0^{a}	0.03^{a}	0^{a}	0^{a}	0.02^{a}

* Primary level=01point ;, Secondary 1st cycle=2pointsSecondary 2nd cycle=3points, University 1st cycle=4points, University 2nd and 3 rd cycles=5points and more.

The activity is led by women (17.22%) and men (82.78%). For the types A and B in Bobo-Dioulasso and C in Kaya, the activity is especially lead by men. For the type B (55%) in Gaoua, the activity is led by more women. For the type C, in Gaoua and Dori, women (32% in each town) were more represented than in Bobo-Dioulasso for the types A (13%), B (8%) and C (15%).

In the whole sample, the main ethnic groups who are pig breeders were the Mossis (49.33%), the Bobos (13.89%), the Lobis (11.56%), the Dagaras (6.11%) and the Samblas (5.33%). The distribution of the different ethnic groups involved (Fig. 6) show that the pig breeders were the native Mossis for the types A and B, Mossis and Dagaras for the type C. In Kaya, for the type C, they were exclusively the native Mossis. The breeders were in the majority some native Bobos in Bobo-Dioulasso for the types A, B and C, some native Lobis in Gaoua for the types B and C. The observations have showed more ethnic groups who are pig breeders in Bobo-Dioulasso (7-11) and Gaoua (4-3) than in the other localities.

As far as religion is concerned, in all the localities and types, the breeders were Catholics (67.33%), Animists (17.89%), Protestants (12.22%),"Muslims" (2.44%) and Free-thinkers (0.11%). In Bobo-Dioulasso, the breeders were Catholics in the type A (73%), B (82%) and in C (82%). In Dori, Catholics were in the types A (100%) and B (75%). In Kaya, they were in the type C (60%). In Gaoua, the Animists were the most represented in the types B (76%) and C (61%) (Table 5). In Bobo-Dioulasso, in the type B (57%) and C (73%), and in Gaoua in the type C (38%), the breeders were mainly farmers. They were breeders and farmers at the same time in Dori in the type B (100%) and in Kaya in the type C (87%). In Gaoua, in the type B, equal numbers of breeders (38%) and farmers-breeders (38%) were noted. In Bobo-Dioulasso, in the type A, the majority of the breeders (33%) have practiced the professions such as butcher, driver, guard, trader, dolo cook, football player, housewife etc. In Gaoua, in the type C the dolo cooks have represented 14%.

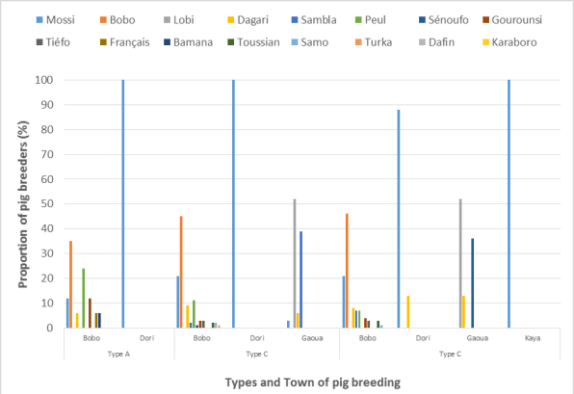

Fig. 6. The ethnic groups to whom the pig breeders belong following the types and the zones in Burkina Faso.

Table 5. The averageTotal number and composition of the flock per pig category following the towns and the types of breeding in Burkina Faso.

Catégories	***Type A***		***Type B***			***Type C***			
	Bobo	Dori	Bobo	Gaoua	Dori	Bobo	Gaoua	Kaya	Dori
Sow	10	5	2^{a}	4^{a}	1^{a}	2^{b}	4^{c}	1^{a}	8^{d}
Boar	2	0	0.8^{a}	1.2^{a}	0^{a}	0.9^{b}	1.4^{b}	0.2^{a}	0.6^{ab}
Female (0-2months)	9	7	2^{a}	3^{a}	1^{a}	1^{a}	2^{b}	3^{b}	10^{c}
Male (0-2months)	13	4	1^{a}	3^{b}	5^{b}	1^{a}	2^{b}	2^{b}	7^{c}
Female (2-5months)	15	0	1^{a}	2^{a}	0^{a}	2.1^{b}	2.1^{b}	0.3^{a}	7.9^{c}
Male (2-5months)	7	0	2^{a}	2^{a}	0^{a}	1.7^{b}	1.4^{ab}	0.8^{a}	1.9^{b}
Female+5months	11	0	3^{a}	1^{a}	0^{a}	2.5^{b}	1.9^{ab}	0.3^{a}	1.9^{b}
Male+5months	5	0	2^{a}	3^{a}	0^{a}	1.8^{b}	2.3^{bc}	0.9^{a}	3.9^{c}

Flock	71	16	15[a]	19[a]	7[a]	13[b]		17[c]	9[a]	41[d]

The averages of the lines with the different letters differ significantly on the threshold of 5%

The structural characteristics of the pig prodution units

The results have shown that the structuring investment was in the domain of the habitat building and in the acquiring of some breeding equipment (Table 6). The investment was decreasing from the type A to the type C. Following the towns, the investment was more important in Bobo-Dioulasso than in Dori for the type A. the type B,the investment in the habitat was not significantly different. The values of the overall equipment and the investment were significantly higher for the town of Bobo-Dioulasso and lower for the town of Gaoua($P<0.05$). the type C,the habitat value of the town of Gaoua was significantly higher than the other towns. The equipment value in the town of Kaya was significantly higher than the other towns.

Table 6. The overall average investment in the habitat and in the equipment of breeding in Burkina Faso.

Posts	***Type A***		***Type B***			***Type C***			
	Bobo	Dori	Bobo	Dori	Gaoua	Bobo	Dori	Gaoua	Kaya
Investment (FCFA)	2888464	2630000	162571[b]	148446[ab]	92352[a]	120416[a]	26656[a]	132804[a]	115495[a]
Habitat (FCFA)	2361514	2300000	100209[a]	96027[a]	79420[a]	65996[a]	17500[a]	109973[b]	25252[a]
Equipment (FCFA)	526950	330000	6362[b]	52419[ab]	12932[a]	55020[a]	9156[a]	22831[a]	90244[b]

The numbers which have the same letter in the same type and on the same line are not significantly different($p<0.05$)

In the type the comparison was not possible between Bobo and Dori which has but one breeding in that type

The materials used in the pig habitat building has varied following the types of breeding and the localities (Fig. 7).

All the types of breeding in the zone of Bobo-Dioulasso have got some wells or some drillings (Table 7). However, only drillings were current in the type A of that town. In all the types and in all the towns, the other kinds of equipment are met. For the type C, the carts are especially indicated in Bobo-Dioulasso and Kaya and the wheelbarrows are more found in Gaoua and Kaya than in Bobo-Dioulasso. For the type B, the wheelbarrows are more usd by the breeders of Bobo and Kaya than the ones of Gaoua.

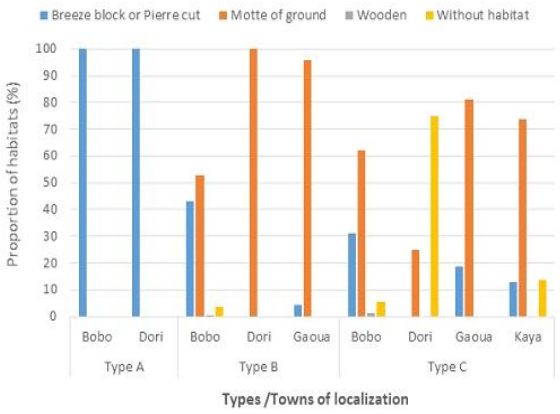

Fig. 7. types of piglet breeding and the building materials of the accomodation following the surveyed localities in Burkina Faso.

Table 7. Facilities and equipment of production heldfollowing the types and the pig breeding localities in Burkina Faso.

Equipment /Material	***Type A***		***Type B***			***Type C***			
	Bobo	Dori	Bobo	Dori	Gaoua	Bobo	Dori	Gaoua	Kaya
wells	0,4	0	0,3	0	0	$0,4^{b}$	0^{a}	0^{a}	0^{a}
drillings		0	0	0	0	0	0	0	0
carts	1,3	0	0,5	1	0	$0,5^{b}$	0^{a}	0^{a}	$0,5^{b}$
Wheelbarrows	1,5	0	$0,3^{a}$	1^{ab}	1^{b}	$0,1^{a}$	$0,3^{ab}$	$0,4^{b}$	$0,2^{ab}$
Shovels	2,3	0	0,9	1	1,2	$0,6^{a}$	$0,3^{a}$	$0,8^{a}$	$0,6^{a}$
Pickaxes	1,3	0	0,9	1	1	$2,6^{a}$	$0,2^{a}$	$1,1^{a}$	$0,5^{a}$
Donkeys	0,8	0	0,4	0	0	$0,4^{ab}$	0^{a}	0^{a}	$0,5^{b}$

Pig husbandry practices

Characteristics of the pig flock in the breeding

The composition of the flock per age section (Table 8, Fig. 6 and 7) has shown that the average total number of the pig flock was more important in Bobo-Dioulasso for the type A than in Dori. For the type B, the average total number was the same in all the towns. For the type C, the average total number of the flock was significantly different in all the towns.

Table 8. The averageTotal number and composition of the flock per pig category following the towns and the types of breeding in Burkina Faso.

Catégories	***Type A***		***Type B***			***Type C***			
	Bobo	Dori	Bobo	Gaoua	Dori	Bobo	Gaoua	Kaya	Dori
Sow	10	5	2^{a}	4^{a}	1^{a}	2^{b}	4^{c}	1^{a}	8^{d}
Boar	2	0	0.8^{a}	1.2^{a}	0^{a}	0.9^{b}	1.4^{b}	0.2^{a}	0.6^{ab}
Female (0-2months)	9	7	2^{a}	3^{a}	1^{a}	1^{a}	2^{b}	3^{b}	10^{c}
Male (0-2months)	13	4	1^{a}	3^{b}	5^{b}	1^{a}	2^{b}	2^{b}	7^{c}
Female (2-5months)	15	0	1^{a}	2^{a}	0^{a}	2.1^{b}	2.1^{b}	0.3^{a}	7.9^{c}
Male (2-5months)	7	0	2^{a}	2^{a}	0^{a}	1.7^{b}	1.4^{ab}	0.8^{a}	1.9^{b}
Female+5months	11	0	3^{a}	1^{a}	0^{a}	2.5^{b}	1.9^{ab}	0.3^{a}	1.9^{b}
Male+5months	5	0	2^{a}	3^{a}	0^{a}	1.8^{b}	2.3^{bc}	0.9^{a}	3.9^{c}
Flock	71	16	15^{a}	19^{a}	7^{a}	13^{b}	17^{c}	9^{a}	41^{d}

The averages of the lines with the different letters differ significantly on the threshold of 5%

The lack of 2-5 months and over 5 months (+5 months) pigs in the types A and B was noted in the Table 8. On the other hand, for all the types, the three age categories of age were met. For the type A in Bobo-Dioulasso the 2-5 months pigs were more frequent to the females (Figure 8) than to the males (Figure 9) to which the 0-2 months pigs were in the dominant position. For the type B, the +5months pigs were more frequent to the females in Bobo-Dioulasso than in Gaoua and in the same frequency to the males. For the type C, to the females as well to the males, the +5months pigs became less frequent in Bob-Dioulasso, Gaoua, Dori and Kaya. In the opposite way, to the females as well to the males, the 0-2months pigs became less frequent.

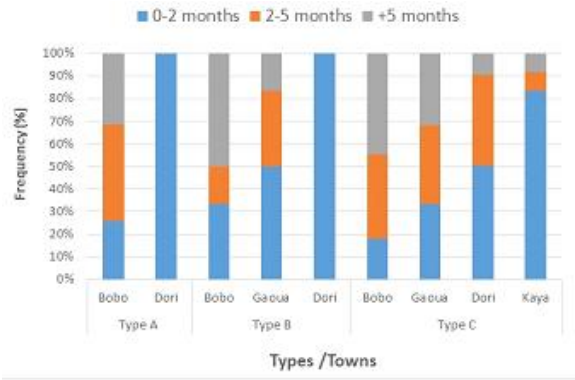

Fig. 8. The frequency in pourcetage of the age sections of the females following the types and the towns of the flock.

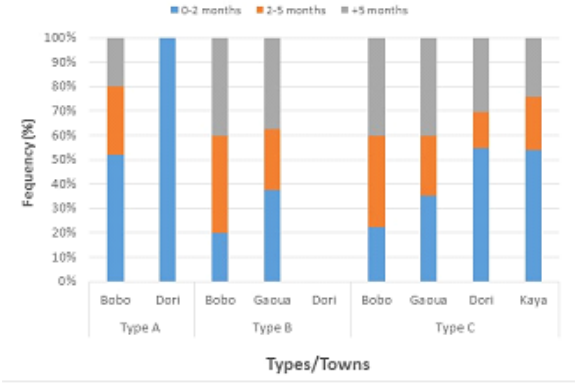

Fig. 9. The frequency in pourcentage of the age sections of the males following the types and the towns of the flock.

Talking about the pig breed raised in the localities following the type of breeding, the Korhogo breed was the most met in the type A in Bobo-Dioulasso as well in Dori (Fig. 10). Its frequency was decreasing from the type A towards the type C. For the type B, it was more frequent in Dori than in Bobo-Dioulasso and in Gaoua. The frequency of the local breed was increasing from the type A to the type C in Bobo-Dioulasso. In Gaoua where it was also, it was more frequent for the type B than C. The Large White breed was the lowest present for all the types. That breed was more frequent in Bobo-Dioulasso for the type A. Some crossbred pigs were weakly represented in Kaya, Dori and Gaoua.

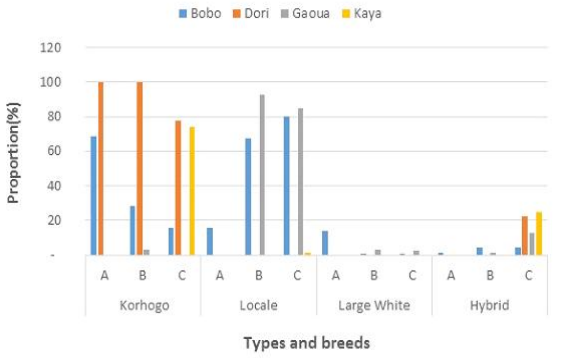

Figure 10. The breed component of thepig breding (%) according to the types and the localities in Burkina Faso.

Caretaking and food

Depending on the ways of pig caretaking according to the localities (Table 9), the seasons and the types of breeding observed, the permanent close (PC) is practiced in the breeding of type A as well in Bobo-Dioulasso as in Dori. In the breeding of type B, the PC was more practiced in Bobo-Dioulasso than in Dori (50% of the pigs were released during the dry season) and in Gaoua; 27% of the breeders practiced Partial close (PaC) and 13% Complete release (CR). Tying up to a peg practice (TyPP) is observed in Gaoua in SS. For the type C, the PC is dominant in Gaoua and Kaya above all in SP, the PaC in SS and SP in Bobo-Dioulasso, the CR during all season in Dori was fairly practiced. The TyPP is peculiar to Gaoua for the type B and in Gaoua and Kaya for the type C.

Talking about the foods of the pigs, save the milling ban for the type A and the fodder for the type B in Dori, the Local beer waste, the milling ban and the fodder were the main foods used for all the pig breeding types and in all the towns (Table 10). In Dori and Kaya, Whatever the type, fruit (mango, nere powder, etc.), the animal salt and the nere powder were not given. The waste of cooking and the rice ban were the foods almost used in Dori, Kaya and Gaoua for the type C. The nere powder was especially used in Bobo-Dioulasso and Gaoua. Maize, industrial beer waste, the cotton rock crab and the garden cultures waste were not used but by the breeders of Bobo-Dioulasso, especially for the type A. The leaves of the potato, the tubers, the peelings of potato and yam and

the local beer yeast were used but in the single town of Gaoua.

Table 9. the frequency (%) of the ways of pig caretaking by the breeders according to the zone, the season and the types of breeding in Burkina Faso.

Ville	***PériodePeriod***	***Type A***	***Type B***				***Type C***			
		pc	CP	PaC	CR	TyPP	PC	PaC	CR	TyPP
Bobo	Dry season	100	99	1	0	0	0	100	0	0
	Rainy Season	100	100	0	0	0	0	99	0	0
Dori	Dry Season	100	50	0	50	0	13	0	87	0
	Rainy season	100	100	0	0	0	40	0	60	0
Gaoua	Dry season	-	52	27	13	9	51	26	8	14
	Rainy season	-	100	0	0	0	98	2	0	0
Kaya	Dry season	-	-	-	-	-	49	0	44	7
	Rainy season	-	-	-	-	-	91	0	0	9

Permanent Close=PC; PaC=Partial Close; CR=Complete Release; Tying at the pasture=TyP

Table 10. The natures of the foods given in the breedings by the breeders in percentage according to the types and the locality in Burkina Faso.

Foods	***Type A***				***Type B***				***Type C***			
	Bobo	Dori	Gaoua	Kaya	Bobo	Dori	Gaoua	Kaya	Bobo	Dori	Gaoua	Kaya
Local beer waste	93	100	-	-	98	100	100	-	97	100	100	100
Mill ban	93	0	-	-	98	100	88	-	98	100	93	100
Fodder	67	100	-	-	73	0	87	-	81	100	82	78
Fruit	73	0	-	-	72	0	84	-	67	0	84	0
SAlt	67	0	-	-	49	0	59	-	51	0	53	0
Nere Powder	67	0	-	-	19	0	41	-	22	0	27	0
Cooking waste	0	0	-	-	1	0	6	-	0	50	11	92
Rice ban	0	0	-	-	0	0	0	-	0	38	2	100
Industrial waste	73	0	-	-	6	0	0	-	2	0	0	0
Dried fish powder	53	0	-	-	6	0	1	-	4	0	2	0
Food formula	47	0	-	-	1	0	0	-	2	0	2	2
Cotton rock crab	20	0	-	-	1	0	0	-	1	0	0	0
Maize	13	0	-	-	2	0	0	-	2	0	0	0
Market gardening waste		0	-	-	2	0	7	-	0	0	0	0
Bones powder	13	0	-	-	2	0	0	-	0	0	0	0
Oyster shell	13	0	-	-	1	0	0	-	1	0	0	0
Stone to lick	13	0	-	-	1	0	0	-	0	0	0	0
Cerals	7	0	-	-	2	0	0	-	1	0	0	0
Blood flour	7	0	-	-	0	0	0	-	0	0	0	0
Peelings of yam	0	0	-	-	0	0	0	-	0	0	4	0
Potato leaves	0	0	-	-	0	0	3	-	0	0	0	0
Potato tuber	0	0	-	-	0	0	0	-	0	0	2	0
Potato peeling	0	0	-	-	0	0	0	-	0	0	2	0
Local beer yeast	0	0	-	-	0	0	1	-	0	0	0	0

Sanitary methods

Some drugs used to remove the parasites (internal and external) were done by 33.33%, 19.3% and 10.2% of the breeders of respectively the types A, B and C in the town of Bobo-Dioulasso and by 3.6% of the breeders of the type C in Gaoua. Some prevention practices for the lack of iron were done by 13.3%, 9.1% and 8.7% of the breeders of the types respectively A, B and C. The vaccination was not current (1.09% for the type B in Bobo-Dioulasso). Some interventions for some preventive measures and the treatments in Bobo-Dioulasso were done by a technician (in 26.7%, 9.1% and 3.9% of the breedings), by the breeder himself/herself (33.3%, 18.5% and 15.6%) for respectively the types A, B and C. In Gaoua, for the type B, the breeders have resorted to a technician (8.8% and 1.8% of them), to themselves (30.9% and 32.7%) and to a technician as well to themselves (4.4% and 7.3%) for respectively the types B and C.

Talking about diseases and symptoms met (Table 11), we have noted that for the type A, the acute respiratory disease and scabies were more frequent in Bobo-Dioulasso. The types B and C, the parasitism (scabies and some other parasitic none determined) and the loss of weight were the common diseases and/or the symptoms to the localities in Bobo-Dioulasso, Gaoua and Kaya and cysticercose was specific to Bobo-Dioulasso and Gaoua. The lack of iron was more frequent in Gaoua for the type B as well C. Diarrhea was noted in Dori especially in the type C. The red mullet and salivating were specific to Gaoua for the type B as well C and the anorexia was specific to Kaya for the type C.

Table 11. Frequency (%) of the suspected pathologies and/or symptoms by the pig breeders according to the types and the localities in Burkina Faso.

Diseases/symptoms	***Type A***		***Type B***			***Type C***			
	Bobo	Dori	Bobo	Dori	Gaoua	Bobo	Dori	Gaoua	Kaya
The acute respiratory disease	7	0	0	0	18	0	60	20	43
parasitism	0	0	40	0	1	49	0	7	10
Scabies	7	0	17	0	3	15	0	2	2
Plague	0	0	7	0	10	17	0	2	10
Cysticercose	0	0	13	0	10	5	0	4	0
Fit of iron	0	0	0	0	16	0	0	22	2
Brucellose	0	0	0	0	0	0	0	0	2
Orchite	0	0	0	0	0	0	0	0	2
Various symptoms*	0	0	2	0	3	1	3	3	2

* Various symptoms: loss of weight, diarrhea, paralisis, ptyalismes, anorexia, nodules, edema, vomitings, eyesaches, fever, prostation, wounds

Constraints of the production

Feeding was the most mentioned constraint by all the pig breeders (Table 12). The problems of pollution and marketing were higher in Kaya and in Dori mainly for the type C. The loss of pigs out of killing was more noted in Gaoua for the breedings of the type B. The pigs were more lost in Dori (for the types A and C). The problems of the technic, economic and land management were especially noted in Bobo-Dioulasso for all the types.

Table 12. The contraints of production in percentage of the breeders following the type and the locality in Burkina Faso.

Contraints Nature	***Type A***		***Type B***			***Type C***			
	Bobo	Dori	Bobo	Dori	Gaoua	Bobo	Dori	Gaoua	Kaya
Feeding	47	100	85	100	97	89	100	93	93
Lack of financial means	13	100	3	-	4	1	50	-	7
Sanitary	13	-	2	100	-	1	13	-	40
Marketing	-	-	14	-	-	20	63	-	52
Method of guard*	-	67	3	-	9	5	50	12	26
Economical and technical management	27	-	20	-	6	19	-	4	-
Land	20	-	28	-	-	22	-	2	-
Successful breed	7	-	7	-	1	6	-	1	-
Equipment	-	-	3	-	3	1	-	4	-
Poor technical ability of the breeders	-	-	-	-	3	-	-	7	-
Repayment of the sizured pigs	-	-	-	-	1	-	-	-	-
Water supply	-	-	0.40	-	-	0.30	-	-	-
Labour	-	-	0.40	-	-	-	-	-	-

* Percentage not level-headed (n=1)

The zootechnical parameters (size of the litter and the interval between the drops)

The zootechnical parameters were not statistically compared between the localities for the type A taking into account the fact that the breedings of that type are almost located only in the town of Bobo-Dioulasso (15/16 of them).The size of the litter (SL) of the local breed for the type A was higher in Dori than in Bobo-Dioulasso (Table 13).

- Except for Dori, the SL of the local breed pigs became more considerable from the intensive breedings towards the less-developed semi-intensive and extensive breeding systems. In Kaya, the SLs of the local breed and the hybrid were higher than those of the Korhogo breed.
- Except for Dori, the SLs of the pedigree pigs and the hybrids were more sizeable than the SL of the local pigs. On the other hand, the interval between the drops (IBD) was less high for the pedigree and the hybrid pigs.
- The SLs of the Korogho breed pigs, significantly the same in the towns of Bobo-Dioulasso and Gaoua, were higher compared to the observations noted in Kaya.

The IBD of that breed was more reduced in Dori than in Bobo-Dioulasso. The hybrids and the LW had roughly the same SL for the type A in Bobo-Dioulasso. The local breed, the Korhogo pig and the hybrids had the same SL in Bobo-Dioulasso and Gaoua where we compared them. The IBD was significantly low in Bobo-Dioulasso, for the local breed and the Korhogo pig, than in Gaoua.

Table 13. size of the litter (SL) and the interval between the drops (IBD) of the pig breeds taking into account the type of breeding and the locality in Burkina Faso.

Breeds	*Local*						*Korhogo*						*Hybrid*						*LW*	
Types	A		**B**		**C**		A		**B**		**C**		A		**B**		**C**		A	
Paramètres	SL	IBD	SL	IBD	SL	IBD	SL	BIBD	SL	IBD	SL	IBD	SL	IBD	SL	IBD	SL	IBD	SL	IBD
Bobo	6 .5	7.5	7.1^{a}	6 6.1^{a}	7.3^{a}	6.2^{a}	7.9	6.8	9.3^{a}	5.6^{a}	^{b}	6.1^{a}	11	7	8^{a}	6^{a}	8.4^{a}	6^{a}	10.7	6
Dori	9	6			7.2^{a}	5.9^{a}	-							-					-	
Gaoua			6.7^{a}	7.3^{b}	7.9^{a}	6.2^{a}	-		7.1^{a}	5.7^{b}	7.7^{b}	6^{a}	7.5^{a}	-	6.4^{a}	7^{a}		6.1^{a}	-	
Kaya					6.9^{a}	6.7^{a}	-				2.3^{a}	4.8^{a}		-			6.8^{a}	6.8^{a}	-	

NB: the values folloed bynthe same letter in the same column are significantly different (p<0.05), LW=Large White

The mortality of the piglets taken as a whole was higher than those of the adult pigs (Table 14). For the type B, the mortality for the local breed in Bobo-Dioulasso was significantly higher (P<0.05) than he mortality of the piglets and lower for the adults in Gaoua. The mortality was more considerable for the piglets of the local breed and the hybrids especially for the extensive breeding system in Gaoua than in the other towns. In Bobo-Dioulasso, it was the piglets which were more touched by the mortality, more sizeable especially in the semi-intensive breeding system.

Table 14. Total numbers (%) of the piglets and the adults died following the types and the localities in Burkina Faso.

Towns	*Pigs breeds*	*Type A*		*Type B*		*Type C*	
		Piglet	Adult	Piglet	Adult	piglet	Adult
Bobo	Local	0.8	-	27.3^{b}	0.06^{a}	9.3^{a}	0^{a}
	Korhogo	0.8	0.4	11.2^{a}	-	10.1^{b}	2.3^{a}
	Hybrid	1.5	-	8.1^{a}	-	9.2^{b}	0^{a}
	Large White		-	-	-	-	-
Dori	Local	-	-	5	-	6.2^{a}	0^{ab}
	Korhogo	-	-	-	-	0^{a}	0^{a}
	Hybrid	-	-	-	-	0^{a}	0^{a}
	Large White	-	-	-	-	-	-
Gaoua	Local	-	-	10.6^{a}	10^{b}	22.4^{b}	10^{c}
	Korhogo	-	-	10^{a}	20^{a}	10^{ab}	12
	Hybrid	-	-	-	-	30^{c}	13
	Large White	-	-	-	-	-	-
Kaya	Local	-	-	-	-	9.9^{a}	2.4^{bc}
	Korhogo	-	-	-	-	0.4^{a}	0.1^{a}
	Hybrid	-	-	-	-	2.9^{a}	0.4^{a}
	Large White	-	-	-	-		

NB: the averages followed by the same letter for the same parametres in the same column are not significantly different between the localities (p<0.05)

The results of the pigs sale (number, takings) (Table 15) have shown that in Bobo-Dioulasso, the number of the sold pigs is decreasing from the intensive breeding system to the extensive breeding system. Taken as a whole, there were more pigs sold in the intensive breeding system, then in the extensive system than in the semi-intensive system. In Gaoua and Dori, the number of pigs sold in the extensive breeding system was more considerable than in the intensive and semi-intensive systems. The breedings of the type B have sold 1.03 times less pigs and got 0.02 time of takings than those of the type C. As for the breedings of the type A, they have sold 1.03 times and once more pigs and got 3.3 times and 3.4 times more takings than the breedings of the respective types B and C.

Bobo-Dioulasso have sold 1.4 time and got 3.7 times more takings than the small towns of Gaoua and Dori; it has sold 10.3 times more pigs and got 23.2 times more takings in the medium town of Kaya.

Table 15. The sale of the pigs per category and takings recorded according to the breeding types and the localities in Burkina Faso.

Ville	***Type A***					***Type B***					***Type C***				
	TN	**PT**	**AD**	**TAK**	**SP**	**TN**	**PT**	**AD**	**TAK**	**SP**	**TN**	**PT**	**AD**	**TAK**	**SP**
Bobo	35	8.2	28.7	1 659218	41365	10.8^{a}	0.3^{a}	10.5^{a}	208369^{a}	21487^{a}	8.6^{b}	0.4^{a}	8.2^{a}	178960^{b}	19936^{b}
Dori	10	10	12	125000	12500	13	14	15	16	17	16.5^{c}	0^{a}	16.5^{b}	373125^{b}	20563^{b}
Gaoua						8.7^{a}	4.2^{b}	4.5^{a}	205941^{a}	24848^{a}	9.6^{b}	5.4^{b}	4.2^{a}	176162^{ab}	18904^{ab}
Kaya											4.8^{a}	0.2^{a}	4.6^{a}	84505^{a}	17115^{a}

TN=total Number of the pig flock ; Pt=average number of the piglets ; Ad=the average number of the adults; Tak=average takings per year ; SP=average Selling Price of one pig

Discussion

Typology of the breedings

Our results highlight three types of pig breedings very distinct in Burkina Faso. The analysis of the coordinates of the main individuals and the determinant variables of the factors show an investment in the important, average and poor factors respectively in the type A (intensive), B (semi-intensive) and the poor C (extensive). Indeed, apart from the variable Education (EDUC) correlated to the axis F2, all the other ones contribute in the same way to determine the level of intensification following the axis F1 (Table2, Figure 2). These results are the same with those of Kiendrebeogo and al. (2008) which report thee (3) production systems for the urban and peri-urban breedings of Bobo-Dioulasso. However, they are different from the characterization of the pig breeding systems of Burkina Faso reported by the FAO in 2012 which describes only two systems of pig breeding (semi-intensive and traditional) in Burkina Faso. The analysis of the representativeness of the breeding types shows that the type A is weakly represented in the geographic and overall domains. This result is the same with Kiendrebeogo and al.'s (2008) who reported also a weak representativeness (0.8%) of the intensive breedings. It is also the same with our results which show a localization nearly of all the semi-intensive breedings of the intensive system in the town of Bobo-Dioulasso contrary to the semi-intensive breedings (Type B) which are more frequent in Gaoua. With regard to the representativeness of the breeding systems and their location, our results match with Mopate and Koussou (2002) who reported that the pig breeding practiced in Tchad is mainly extensive in particular in the rural and peri - urban zones. The observations show the importance of the little semi-intensive breedings and in particular those extensive in the pig meat supply of the towns of Africa in the South of Sahara (Dongmo *et al.*, 2005; Ndebi and Ongla, 2006; Mopate *et al.*, 2010). The results show also that the efforts of the improvement of the production in these breedings would allow to

increase the meat availability. This distribution highlights the intensification dynamics concentrated on two (2) ways:

- The intensification of the type C breedings towards the type A breedings meaning a development dynamics of the traditional breedings into intensified breedings (types B and A). That tendency already reported by Kiendrebeogo *et al.* (2008) is the repercussions of the development of the towns and the urban areas which are at the same time a potential market for the selling of the breeding products and are some sources of input supply marked out for the production ;
- An intensification dynamics going from the big towns (+900,000 inhabitants) represented by Bobo-Dioulasso towards the medium towns (50,000-90,000 inhabitants) such as Kaya, Dori and Gaoua (Ouattara and Some, 2009).

The opposite tendency for Gaoua (medium town) in the South-West region to concentrate more semi-intensive pig breedings than Kaya in the Central North could be explained by the age-old character of pig breeding in the town of Gaoua. Indeed, the average age of the pig breedings for the type B and C in Gaoua was comparable to those of the all types of breedings in Bobo-Dioulasso (Table 2) contrary to a more recent settlement of the breedings in Dori and Kaya. Moreover, Gaoua counts 3.8 times less Muslims (14%) than Kaya (66.7%) and 5.8 times less than Dori (94.4%) according to Somda and Some (2009), Bado and Zongo (2009) and Boly (2009). Here is a religious constraint which limits without any doubt the development of the pig breedings systems in the towns which have more Muslims. This situation was the cause of the failure of the settlement of the pig breedings in the northern part of Tchad (Mopate *et al.*, 2006).

The types and the running's structure have shown that the types of breedings differ from the level of investment in the facilities and in the equipment. This level was mostly determinant in the structural characteristics of the breedings. Indeed, the average investment value in the type A (2,759,232 FCFA) represented 20 to 27 times those of the types B and C. The pigs' habitat of these breeding entirely build with some lasting material would justify those differences in comparison with the breedings of the type B where we noted an average use of these materials completed with some local bricks said to be less lasting. For the breedings of the type C, the pigsties build with wood explain the poor investment in that type of breedings. This structure of the running's tallies well with the one described for the pig breedings in the West Africa (Porphyre, 2009) in Ouagadougou and Bobo-Dioulasso, in Burkina Faso (Drabo, 2007; Kiendrebeogo *et al.*, 2012). The mode of the extensive breeding demands not a lot of money, work and inputs investment, the pigs of the semi-intensive breedings were sheltered in some rustic pigs tries built with some local materials (local bricks) unlike the intensive breedings which through their name shows that the pigs are grown in a confined space . Talking about work, the use of paid labors is the privilege of some intensified breedings (types A and B) in the big and medium towns of Bobo-Dioulasso and Kaya unlike the traditional extensive breedings (Type C) of the little towns (Gaoua and Dori) which appeal mainly the family manpower.

The method of breeding shows a research for a great productivity in the type A and a trade position. Indeed, the important total numbers of the pigs, a very great presence of some productive breeds (Korhogo and hybrids), a permanent close, the important investment in food and the pig's health are the main supporting elements. The sub-products (SP) which are the basis of the pigs' food (local beer waste, milling bans, decommissioning fruits) and various fodders are common to all the types. Taken as the whole, these foods are the same as those described by the FAO in 2012 when they surveyed about the pigs breeding in Burkina Faso. However, some differences are noted in each locality. The range of the foods used is more limited in Dori and Kaya than in Bobo-Dioulasso where it is very diversified (17 kinds of foods) with the resort of the some foods specific to the region such as the industrial beer waste, the blood and dried fish flours and the cotton rock crab. In

Gaoua, With 10 kinds of foods, the range was more reduced than in Bobo-Dioulasso; however, the breeders used the tubers as the regional food specificity. The specified and varied range of the SP used in the type A (intensive) and in a less measurement in the type B show the research of a more balanced food in these types if compared to the type C of the traditional extensive breedings.

Many contraints which hinder the development of the pigs breeding in Burkina Faso were named by the breeders. The main constraints were of food, of sanitary and of financial natures. These contraints are noted in various ways following the type of breeding as well the region where the breeding is located. The same contraints were observed in Cameroon, in Central Africa and in Tchad (Ndebi and al.2009; Mopate *et al.*, 2010). In terms of the weak availability and the high cost of the raw materials as well the limited knowledge of the breeders of a good feeding methods, feeding was the first constraint (Table 9). This observation was also done about the peri-urban and the urban breedings of Bobo-Dioulasso (Kiendrebeogo, 2006) and of Ouagadougou (Drabo, 2007) in Burkina Faso. The food constraint was more met in the small towns (Dori and Gaoua), then in the medium towns as Kaya and finally in the less advanced semi-intensive (Type A) and extensive (Type C) breeding systems. This observation was also noted in Tchad (Mopate and Koussou, 2002) where pigs' food, especially during the rainy season, was one of the major contraints to the pig's production, as said by 90% of the breeders in rural area. The feeding constraint as reported in Tchad is similar to the observations recorded in the extensive pig breedings of Gaoua in the South-West of Burkina Faso. Just at the end of the rainy season the pigs were systematically released for ramblings.

The performances reached by the pig breedings running in Burkina Faso were dependent on the types of breedings and their geographical location. The good and confirmed zootechnical performances of the pigs of the improved breeds and the hybrids in the intensified systems A and B result from a good breeding method (permanent close, feeding, sanitary and the maintenance). However, the considerable mortality of the piglets in the semi-intensive system and the adults in the extensive system in Gaoua remains the main concern. The identification of the constraints of the pigs breeding in Ouagadougou (Drabo, 2007) which is comparable to the town of Bobo-Dioulasso had shown the same tendency of the mortality. Nevertheless, the mortality reported is higher for the categories of pigs (piglets and adults) as well for the same breeding systems. If some reasons such as ramblings and the sanitary constraint can explain this phenomenon, some complementary researches would be necessary to explain better and to identify the best solutions for a good sanitary method. The incomes providing from the selling takings of the pigs are higher in the type A and decreasing towards the type C. We noted that the breedings of the type C had sold more pigs than the ones of the type B. This situation apparently contradictory gives an account of the better weight productivity of the intensified breedings (types A and B) which would have allowed to make up the weakness of the number of pigs sold in B. It is also probable that the type C composed of little farmers without any great means of subsistence use the pigs to face their needs. The tendency of the great towns (Bobo-Dioulasso) to sell more pigs and to get more takings than the averages (Kaya) and than the little towns (Dori and Gaoua) can be justified by the urbanization which is a factor of the creation of a market for the agricultural products.

Conclusion

A dynamic stratification of the pig breedings in some extensive, semi-intensive and intensive breeding systems was observed. The results highlight the presence of all types of breedings in Bobo-Dioulasso where the intensive breedings are located (Type A). The intensification oriented from the big to the little towns and from the rural area to the outskirts of the towns bears witness to the research of a more great productivity in order to increase the production and to satisfy a demand linked to the growing urbanization. Some investigations on the last step of

the pig industry (trading, transformation) in Bobo-Dioulasso should be done to assess the contribution of the pig breeding to the meat supply in that town. The characterization of the form of the pig breeds and the study of its influence on the production taking about the variety of the breeds in the flock could be some necessary researches for a better management of the politics of genetic improvement. Our works put an emphasis on the feeding which was the first constraint in the different towns as well in all the systems of breeding. In view of its importance to the pig breeding, the research of some solutions in order to make the foods more available to the pigs while mitigating the competition between the latters and the Man proves to be a pressing necessity. The exploration of the possibilities of the production of some non-conventional food successful and economically acceptable by the pig breeders could be a way to an increase of the production of the meat in lower costs.

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