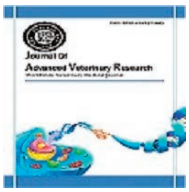
Journal of Advanced Veterinary Research

https://advetresearch.com



Reproductive Performances of Local Pigs in West African Countries: A Review

Ignace O. Dotché[1*], Gabriel A. Bonou[1,5], Mahamadou Dahouda[2], Nicolas Antoine-Moussiaux[3], Jean-Paul Dehoux[4], Guy A. Mensah[5], Souaïbou Farougou[6], Pierre Thilmant[3,7], Issaka Youssao Abdou Karim[1], Benoît G. Koutinhouin[6]

[1]Department of Animal Production and Health, Laboratory of Animal Biotechnology and Meat Technology, Polytechnic School of Abomey-Calavi, University of Abomey-Calavi, 01 BP 2009, Cotonou, Benin.
[2]Department of Animal Production, Faculty of Agronomic Science, University of Abomey-Calavi, 01 BP 526, Cotonou, Benin
[3]Fundamental and Applied Research for Animals and Health, Faculty of Veterinary Medicine, University of Liège, Vallée 2, Avenue de Cureghem, 4000 Liège, Belgium.
[4]Laboratory of Experimental Surgery, Universite Catholique de Louvain, 55/70, Avenue Hippocrate, 1200, Brussels, Belgium.
[5]Agricultural Research Center of Agonkamey, National Institute of Agricultural Research of Benin, 01 BP 884, Cotonou, Benin.
[6]Department of Animal Production and Health, Polytechnic School of Abomey-Calavi, University of Abomey-Calavi, 01 BP 2009, Cotonou, Benin.
[7]Provincial Center of Productions Animales, Liège (CPL Animal), Rue de Saint Remy, 5 B4601 Argenteau, Belgium.

ARTICLE INFO

Review Article

Received:
18 October 2019

Accepted:
28 December 2019

Keywords:

Local pig, Performances, Reproduction, Biotechnology, West Africa

ABSTRACT

The local pig is reared in all West Africa countries, and especially in small farms, playing so an important role in its preservation. This article reviews work done on reproductive performances of local pigs in West Africa. These performances focus on age at puberty, estrus and sex cycle, gestation length, prolificity, viability and growth before piglets weaning. Factors that can influence these parameters are included. Finally, the contribution of animal biotechnology to these performances improvement is discussed.

J. Adv. Vet. Res. (2020), 10 (1),49-55

Introduction

Pigs reared in West African countries are of three genetic types. These include local pigs, exotic-breed pigs (Large White, Landrace, Pietrain, Meishan) and crossbreeds between local pigs and exotic breeds (Ironkwe and Amefule, 2008; Djimenou *et al.*, 2017; Youssao *et al.*, 2018). Local pigs are mostly reared in free-range or in temporary confinement, resulting in low zootechnic performances (Youssao *et al.*, 2008; Dotché *et al.*, 2018). Therefore, they are reared mostly by small rural farmers in traditional system. On the other hand, their meat is highly valued by consumers compared to exotic pork because it is marbled (Deka, 2008). This meat appreciation by the population and the local pig high adaptation to our climatic conditions aroused lots of work to improve its numerical and weight productivity. This work has exposed the constraints that reduce the performance of this breed, such as the low level of know-how of farmers, absence of quality feed in farms, absence of appropriate management and marketing structures and health problems and animal material and equipment supply (Youssao *et al.*, 2008; Ndébi *et al.*, 2009; Porphyre, 2009; Mopaté *et al.*, 2014). In order to find solutions to these constraints, local sows numerical productivity has been improved by the breeding mode improvement (Koutinhouin *et al.*, 2009). Growth performance was also improved through crossbreeding with the exotic breeds Large White and Landrace (Youssao *et al.*, 2009b; Nwakpu and Onu, 2011). The reproductive parameters, such as farrowing interval, weaning-to-mating interval, and age at the first farrowing are very little reported in these various work. However, the development of this local pig's breeding will also require the control of their reproduction, influencing then their interest in an important economic

*Corresponding author: Ignace O. Dotché
E-mail address: dotcheign@gmail.com

ISSN: 2090-6277/2090-6269/

perspective in breeding.

This review aims to make a point of work carried out on the reproductive performances of local pigs in West Africa in order to contribute to the setting of strategies improving their productivity.

Distribution and denominations of local African pig in West Africa

Local pigs (Figures 1 and 2) are reported in all countries in West Africa, from Senegal to Nigeria (Meyer, 2019). This breed origin is controversial, but recent work on molecular genetic characterization has admitted that local pigs' breeds could come from the Middle East through Egypt and from the Far-East through trades across Indian Ocean, this because alleles and genes of breeds from these areas are found in local breeds (Ramírez *et al*., 2009; Amills *et al*., 2013; Lesur-Gebremariam, 2014; Agbokounou *et al*., 2016; Osei-Amponsah *et al*., 2017). Several terminologies are used to name this animal according to countries. For example, it is called West African Dwarf pig (Nigeria) and Ashanti pig (Ghana) (Meyer, 2019). This breed has almost the same phenotypic characteristics in all African countries where it exists. It is a small animal that has a uniform black or white color, sometimes pieblad, and with long or short dense hairs (Alenyorege *et al*., 2015; Youssao *et al*., 2018). Its body is 49 to 52 cm long and ends with a long head (25 cm) (Okoro *et al*., 2015; Youssao *et al*., 2018). Found in most of the African countries, it tolerates food irregularities and is heat-resistant, and for that is more breeded in traditional livestock farms, especially in rural areas (Agbokounou *et al*., 2016; Dotché *et al*., 2018). In this system, the breeder gives little importance to his feeding and to the health monitoring. The feeding consist to the distribution of cereal and fruit residues, of leguminous plants and of food leftovers (Ossebi *et al*., 2018). It is appreciated by breeders for its disease resistance and by consumers for its meat quality (Agbokounou *et al*., 2016). Unfortunately, these performances are low and are improved by exotic pigs in farms. The weight at 180 days old is 19.2 kg (Darfour-Oduro *et al*., 2009) and when the animal is 365 days old (1 year) (Abdul-Rahman *et al*., 2016), its weight is 51 kg. Beyond one year, the weight reaches 62 kg (Karnuah *et al*., 2018).

Fig. 1. Local sow

Age at puberty and age at first mating

Local pig has sexual precocity that is not valued in traditional breeding (Agbokounou *et al*., 2016). Under traditional breeding conditions, the age at puberty of West Africa local pig ranges from 221 days to 245 days and sometimes 302 days in free range (d'Orgeval Dubouchet, 1997; Nonfon, 2005; Nwakpu and Ugwu, 2009; Nwakpu and Onu, 2011; Agbokounou *et al*., 2016). This age is similar to the reported age of

Fig. 2. Local boar

210 days for local pig in Central Africa (Mopate *et al*., 2011) and of 254.5 days for Bangladesh (Ranjit Chandra Sinha *et al*., 2015). By improving feeding, the age at puberty decreases to 146/150 days (Chiboka, 1981; Nonfon, 2005). This age is the same in the local pig (149 days) in Central Africa (Cameroon) in improved farm (Kouamo *et al*., 2015). The age at puberty is 262 days for Landrace and 267 days for Large White (Nwakpu and Ugwu, 2009; Nwakpu and Onu, 2011). The age at puberty of sows is influenced by temperature, light, group or individual breeding, confinement or freedom, male exposure and feeding (Knox and Wilson, 2007; Leborgne *et al*., 2013). The age at puberty of these exotic pigs does not differ from that of the local pigs when they are reared under the same conditions (same feeding, habitat and health monitoring) (Nwakpu and Ugwu, 2009). However, this performance similarity is observed especially in improved farm and these foreign breeds rearing in traditional farm may affect this parameter if sows do not die. Variations in age at puberty in different studies and regions are due to variations in breeding practices, feeding practices, climatic conditions and genetic types (Ranjit Chandra Sinha *et al*., 2015).

The age at first mating in improved breeding system in Benin is 6 months (Youssao *et al*., 2009a, 2009b). The growth delay caused by the mismanagement in traditional breeding mode increases the age to 9 months (Dotché *et al*., 2018). The age at puberty of local boar in West Africa is not reported in the literature, but local boar in the tropical region reaches puberty around 4 months (Holnes and Chaboeuf, 1997) and is used to mate sow at 8 months of age (Dotché *et al*., 2018).

Estrus and sexual cycle

The sexual cycle of the local sow is continuous and lasts 21 days (Aladi *et al*., 2008). This can sometimes reach 22 days (Mezui-Mezui, 2000). The cycle duration is the same for local sows in Bangladesh (Ranjit Chandra Sinha *et al*., 2015) and European breeds (IFIP, 2013; Leborgne *et al*., 2013). Thus, the genetic type did not influence the sexual cycle. During estrus, there are changes in behavior and in genital organs. Estrus usual signs in sows are: vulvar reddening and swelling, mucous discharge, nervousness, increased activity, and standing at the boar (Helke *et al*., 2015). In the local sow, estrus is less detectable in pubertal gilt than in sow of at least one farrowing and the most effective estrus indicator was the immobility reflex in a boar presence (Aladi *et al*., 2008). Vulva swelling is minimal in local sows and vulva generally appears dark in contrast to the red color reported in exotic breeds such as Large White (Aladi *et al*., 2008).

The estrus duration of the local sow varies between 2-3 days (Mezui-Mezui, 2000). The cycle other periods' duration are 2-3 days for metoestrus, 14-15 days for dioestrus and 3 days for pro-estrus (Mezui-Mezui, 2000). The progesterone concentration varies from phase to phase (Mezui-Mezui,

2000). During each phase, progesterone concentration often varies from single to double, from female to female (Mezui-Mezui, 2000). These variations in progesterone concentration are not specific to the local sow; they are also found in exotic sows (Mezui-Mezui, 2000; IFIP, 2013). The matings are performed at two thirds of the estrus period. Weaning-mating interval is very long (at least 8 weeks) in traditional breeding (Buldgen *et al*., 1994; Dotché *et al*., 2018). When housing and feeding conditions are improved, this interval decreases by 3 weeks or 5 weeks after weaning (Dotché *et al*., 2019). Apart from breeding hard conditions (inadequate feeding, care and habitat) that would justify this situation, breeders lack in know-how makes estrus often unnoticed (Dotché *et al*., 2019). Sows are mated between 31 and 41 days after weaning in improved farms with improved pigs (Dotché *et al*., 2018, 2019; Abah *et al*., 2019).

Duration of gestation

Pregnancy diagnosis in sows in West Africa is performed by observing estrus signs 20 to 21 days after mating (Aladi *et al*., 2008). The gestation length of local sows in improved breeding in West Africa ranges from 111 to 114 days (Chiboka, 1981; Aladi *et al*., 2008; Nwakpu and Onu, 2011). Gestation length is difficult to determine in traditional breeding because dates of mating are not often known in this system. The traditional breeding is characterized by animals' divagation and matings are performed without the knowledge of the breeder. The gestation length is not very dependent on the age at first mating (Chiboka, 1981). This duration is 113 days for matings between 7 and 9 months of age and 114 days for females mated between 11 and 13 months of age (Chiboka, 1981). The gestation lengths of local sow are shorter than those of exotic breeds sows (Large White and Landrace) and their crossbreds with the local pig in West Africa (Aladi *et al*., 2008; Nwakpu and Onu, 2011). These exotic or crossbred sows have a gestation length ranging from 116 to 122 days (Aladi *et al*., 2008; Nwakpu and Onu, 2011). The difference between the gestation length of local sows and exotic sows in West Africa may be due heat stress influence on exotic sows. Heat stress (temperature and humidity of the air) reduces the reproductive performances by increasing respiration and rectal as skin temperatures and by reducing feed consumption and sow activity (Suriyasomboon *et al*., 2006; Williams *et al*., 2013; Lucy and Safranski, 2017). This effect must be more elucidated by studies in our breeding conditions since Lucy and Safranski (2017) report a decrease in gestation lengths in sows submitted to heat stress in USA while Suriyasomboon *et al*. (2006) report no effect of heat stress on gestation lengths of sow in Thailand.

Age at first farrowing and farrowing interval

Age at first farrowing is one of the factors that used to estimate age at the first fertile mating, especially in traditional breeding where matings took place in divagation. In Benin, this age is 369 days for local sows in traditional breeding (d'Orgeval Dubouchet, 1997; Nonfon, 2005). The age at first farrowing in traditional farms dominated by the local breed in Senegal ranges from 383 to 495 days (Buldgen *et al*., 1994; Missohou *et al*., 2001). The age at first farrowing of sows in West Africa is similar to that of local sows in Central Africa (Mopate *et al*., 2011). The farrowing interval of local sows in traditional farms is 209 days and 180 days in improved breeding (d'Orgeval Dubouchet, 1997; Kiendrebeogo *et al*., 2012). The same intervals are reported in Large White sows (Kiendrebeogo *et al*., 2012). This interval is influenced by the estrus detection technique and is longer when estrus goes unnoticed.

Litter size at birth

Litter size at birth of local sow in West Africa ranges on average from 5.3 to 8.8 piglets (Table 1). The litter size is higher in improved breeding mode where sows are well fed and better monitored. Thus, litter sizes are 5.3 piglets (Koutinhouin *et al*., 2009) and 5.7 piglets (Youssao *et al*., 2008) in traditional breeding in Benin compared to 7.2 to 7.5 piglets (Youssao *et al*., 2009a, 2009b) and 8.8 piglets (Koutinhouin *et al*., 2009) in improved breeding. This difference is justified by the embryonic mortality reduction due to dietary supplement provided to sows in improved breeding (Koutinhouin *et al*., 2009). The farrowing season influences the litter size. It ranges from 4.7 to 6.4 piglets in the rainy season compared to 6.3 to 6.6 piglets in the dry season (Oseni, 2005; Oluwole and Omitogun, 2015). The litter size at birth of local pigs is lower than that of exotic pigs ranging from 8 to 10 piglets for Large White in improved breeding in Benin (Youssao *et al*., 2009b; Nwakpu and Onu, 2011) and 9 piglets for the Landrace in Nigeria (Nwakpu and Onu, 2011). An improving crossbreeding to 75% of Large White blood improves the local sow litter size at birth.

Born alive number and viability at weaning

The number of piglets born alive per litter of the local sow ranges from 4.6 to 8.3 (Youssao *et al*., 2008, 2009a, 2009b; Koutinhouin *et al*., 2009). This number varies depending on the breeding mode (Koutinhouin *et al*., 2009). In traditional mode, the number of born alive is 5 piglets (Youssao *et al*., 2008; Koutinhouin *et al*., 2009) compared to 6 to 8 in improved mode (Youssao *et al*., 2008; Koutinhouin *et al*., 2009).

The stillborn rate ranges from 17% to 19% (Youssao *et al*., 2008; Youssao *et al*., 2009a) and is influenced by the breeding mode. It is higher in traditional mode than in improved mode (17% vs 19%) (Youssao *et al*., 2008, 2009a; Koutinhouin *et al*., 2009). The number of stillborn is one piglet per litter (Koutinhouin *et al*., 2009). The average of birth- weaning mortality rate ranges from 15% to 33% (d'Orgeval Dubouchet, 1997; Nonfon, 2005; Youssao *et al*., 2008, 2009b; Koutinhouin *et al*., 2009; Agbokounou *et al*., 2017b). This rate is higher in traditional breeding than in improved breeding (Youssao *et al*., 2008, 2009b). The lack of animal care in traditional beedings favors the outbreak of diseases like scabies and other diseases symptoms such as diarrhea, cough, and weight loss that cause these mortalities (Youssao *et al*., 2008). Mortalities appear mainly from the second week, because the rate of antibodies transfer from sows to piglets is very low (Agbokounou *et al*., 2017b).

The litter size of local sow at weaning ranges from 3.4 to 5.7 piglets (Oseni, 2005; Koutinhouin *et al*., 2009; Youssao *et al*., 2009b; Nwakpu and Onu, 2011). It is higher in improved breeding than in traditional (Koutinhouin *et al*., 2009; Youssao *et al*., 2009a). The litter size at weaning is 3.4 piglets over 4.9 born alive in traditional breeding and 5.6 piglets over 8.3 born alive in improved breeding (Koutinhouin *et al*., 2009). The 8-week-old local piglet survival rate is higher in the dry season than in the rainy season (86.91 *vs* 77.78%) (Oluwole and Omitogun, 2015).

Weight at birth

The local piglet weight at birth ranges from 535 g to 810 g (Uko *et al*., 1994; Koutinhouin *et al*., 2009; Youssao *et al*., 2009a, 2009b) in traditional breeding and from 650 g to 1180 g in improved breeding where animals are well fed and given care (Table 1). It varies from country to country because of the

breeding mode differences. In Benin, local piglets weight at birth ranges from 531 g to 658 g (Youssao *et al*., 2008, 2009b; Koutinhouin *et al*., 2009). This weight is from 800 g to 920 g in Nigeria (Oseni, 2005; Nwakpu and Onu, 2011; Okoro *et al*., 2015) and about 1000 g in Ghana (Darfour-Oduro *et al*., 2009; Abdul-Rahman *et al*., 2016). It decreases with litter size increase (Abdul-Rahman *et al*., 2016) and beyond 8 piglets, the weight becomes lower (Abdul-Rahman *et al*., 2016) and piglet's survival chance at weaning is reduced. The birth weight of local piglet is improved by crossing with exotic breeds (Youssao *et al*., 2009b) and a local piglet is less heavier than an exotic piglet in improved breeding (Aladi *et al*., 2008; Youssao *et al*., 2009b). This weight ranges from 852 g to 1300 g for local x Large white crossbreed piglets (Nwakpu and Ugwu, 2009; Youssao *et al*., 2009b) and from 1170 g to 1800 g for local x Landrace crossbreeds piglets (Nwakpu and Ugwu, 2009). For exotic breeds reared in improved mode, the birth weight is 886 g for a Large White piglet in Benin (Youssao *et al*., 2009a) and ranges from 1300 g to 1500 g for a Large White or Landrace piglet in Nigeria (Aladi *et al*., 2008; Nwakpu and Ugwu, 2009). On the contrary, sex, breeding mode and farrowing season do not influence piglet birth weight (Abdul-Rahman *et al*., 2016; Koutinhouin *et al*., 2009; Oluwole and Omitogun, 2015).

Piglet growth and weaning weight

The local piglets growth in traditional breeding system is low (Figure 3). The birth-weaning average daily gain ranges from 30 to 34 g/d (Koutinhouin *et al*., 2009; Agbokounou *et al*., 2017b). When the breeding conditions are improved, this average daily gain increases to 55 g/d (Koutinhouin *et al*., 2009). Under improved breeding system, local pigs have a lower growth rate between birth and weaning than exotic pigs (Large White) (Okeudo *et al*., 2007; Youssao *et al*., 2009b). Local piglets female and male do not have significant difference in growth rates in the traditional system (Koutinhouin *et al*., 2009). By contrast, in improved breeding, males grow faster than females between birth and weaning (Youssao *et al*., 2009a).

The weaning weight (at 62 days) of local piglet in improved breeding system is 4.5 kg in Benin (Youssao *et al*., 2009b) and ranges from 3.8 kg to 6 kg in Nigeria (Aladi *et al*., 2008; Ajayi and Akinokun, 2013; Oluwole and Omitogun, 2015). In Ghana, weaning weights reported are 5.7 to 6.2 kg per piglet (Abdul-Rahman *et al*., 2016; Darfur-Oduro *et al*., 2009). Season and sex do not influence the weight of piglet at weaning (Abdul-Rahman *et al*., 2016; Oseni, 2005; Oluwole and Omitogun, 2015). On the other hand, the litter weight at weaning is improved by the breeding mode (Koutinhouin *et al*., 2009) and by crossing with exotic breeds (Oseni, 2005). The litter weight of local pigs is 9.6 kg (3.44 piglets) in traditional breeding in Benin compared to 20.3 kg (5.6 piglet litter) in improved farming (Koutinhouin *et al*., 2009) and 32.5 kg in Nigeria (Oseni, 2005). Exotic pigs (Landrace and Large White) reared in West Africa have a heavier litter at weaning than local pigs (Nwakpu and Onu, 2011). It weighs 76.1 kg for Large White and 67.8 kg for Large White x local pig crossbreeds (Oseni, 2005). The genetic type effect on the litter weight is explained not only by the growth rate of exotic pigs and crossbreeds, but also by the litter size which is higher than that of the local breed. Besides, exotic pigs (Large White) and crossbreeds (Large White x local pig) have higher weight gains than local pigs in the first two months of life (Youssao *et al*., 2009a). It is important to note that weaning weight is difficult to determine in the traditional system because weaning is natural. The age at weaning is late and may reach 90 days in this system (d'Orgeval Dubouchet, 1997). Weaned piglets have birth weight significantly higher than birth-weaning dead piglets (0.73±0.05 vs 0.54 ± 0.07kg) (Uko *et al*., 1994).

Age at weaning

The age at weaning of local piglets in West Africa ranges from 41 to 90 days (Table 1). This age is influenced by breeding mode. When sows are reared in a system where they are well fed and given care, piglets grow faster and are weaned earlier. For example, the age at weaning reported in improved mode is 50 days compared to 53 days in traditional mode (Koutinhouin *et al*., 2009). On station in Benin, , the age at weaning is 62 days (Youssao *et al*., 2009b) and 41 days in Nigeria (Aladi *et al*., 2008). In traditional breeding, piglets are

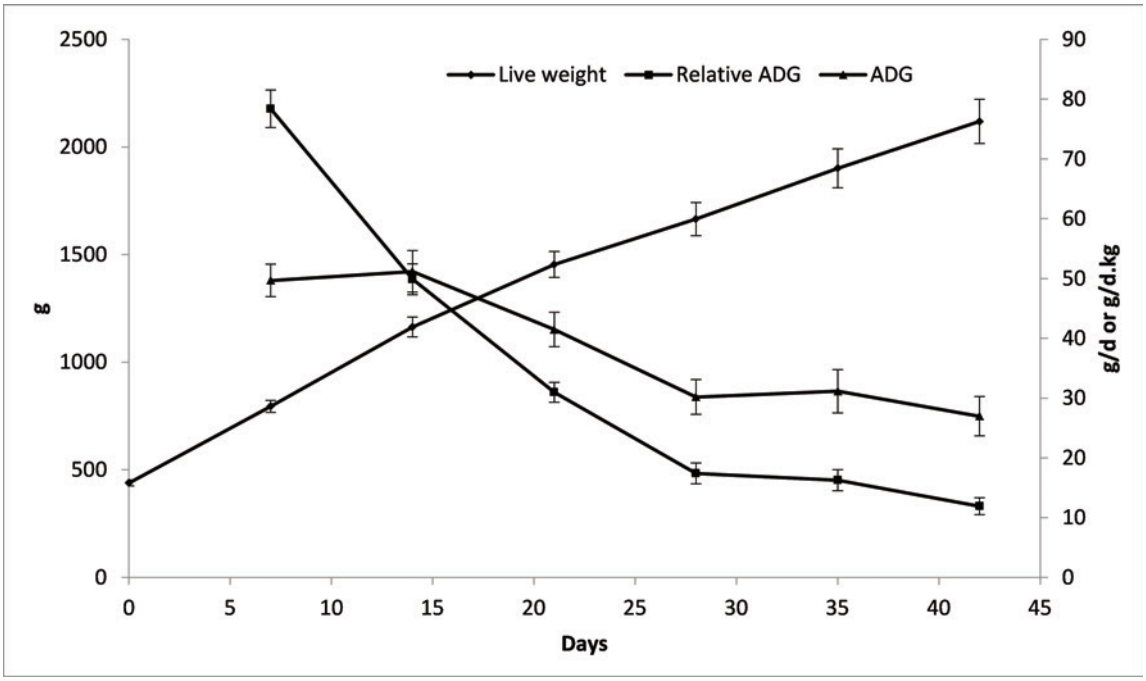


Fig. 3. Evolution of live weight, Average Daily Gain (ADG) and relative Average Daily Gain (RADG) in local breed of piglets in Benin (Agbokounou *et al*., 2017a).

weaned at 90 days (d'Orgeval Dubouchet, 1997). The differences between the weaning ages are due to the breeding conditions of systems and to the genetic diversity of local breed between West African countries.

Milk production

Local sow milk production in 56 days is 79.4 kg (Adebambo and Dettmers, 1982). This milk contains 9.3% of lipid, 6.9% of protein, 5.4% of lactose, 0.5% of calcium and 0.2% of phosphorus (Adebambo and Dettmers, 1982). Colostrum in local sows is concentrated in IgG (22 mg/ml) but these antibodies are lowerly transmitted to piglets (Agbokounou *et al.*, 2017b). Thus, piglets serum IgG concentration at 7 days old is 2 mg/ml compared to 7 mg/ml obtained in improved breeds (12-18 mg/ml in sows) despite the good IgG content of colostrum (Agbokounou *et al.*, 2017b).

Improvement of reproductive performances through biotechnology

Reproductive biotechnologies include techniques such as artificial insemination, embryo transfer, sexing and cryopreservation of gametes and embryo, in vitro fertilization, cloning or transgenesis (Bidanel *et al.*, 2003). Among reproductive biotechnologies, artificial insemination is the most widely used in animal production in Africa (FAO, 2008). In pig farms in West Africa, the possibility of the use of artificial insemination to improve zootechnical performances was discussed in Nigeria in 1977 (Dede and Steinbach, 1977) and conditions for its implementation were studied in Benin in 2005 (Ayssiwede, 2005). It was included in the genetic improvement program in Côte

Table 1. Reproductive performances of local pig in some Africans countries

Parameters	Countries	Value	Author
Age at puberty (days)	Nigeria	245.00±3.00	Nwakpu and Onu (2011)
Gestation length (days)	Benin	118.00	Nonfon (2005)
	Nigeria	111.00±1.00	Nwakpu and Onu (2011)
		111.7±0.79	Aladi *et al*. (2008)
		113.0-114.0	Chiboka (1981)
Litter size at birth	Benin	5.50±1.96*	Agbokounou *et al*. (2017b)
		5.70 2.10	Youssao *et al*. (2008)
		7.20±2.30	Youssao *et al*. (2009b)
		7.50±1.90	Youssao *et al*. (2009a)
		8.80±3.20	Koutinhouin *et al*. (2009)
		5.30±2.10*	
	Burkina	7.00±2.00	Kiendrebeogo *et al*. (2012)
	Ghana	7.50±10	Abdul-Rahman *et al*. (2016)
	Nigeria	6.50 ±0.02	Nwakpu and Onu (2011)
		5.10±1.70	Aladi *et al*. (2008)
		5.30±0.30	Nwakpu and Onu (2007)
		8.00±1.00	
		6.80	Oseni (2005)
Litter size at weaning	Benin	4.90±2.30*	Agbokounou *et al*. (2017a)
		5.70±2.00	Youssao *et al*. (2009b)
		5.60±2.60	Koutinhouin *et al*. (2009)
		3.40±1.50*	
	Nigeria	5.50±0.10	Nwakpu and Onu (2011)
		5.50	Oseni (2005)
Birth weight (kg)	Benin	0.40±0.100*	Agbokounou *et al*. (2017a)
		0.50±0.10	Youssao *et al*. (2009a)
		0.60	Koutinhouin *et al*. (2009)
		0.70*	
	Ghana	1.00±0.30	Abdul-Rahman *et al*. (2016)
		1.00±0.20	Darfour-Oduro *et al*. (2009)
	Nigeria	0.80	Nwakpu and Onu (2011)
		0.80	Oseni (2005)
		0.90	Ajayi and Akinokun (2013)
		0.90	Okoro *et al*. (2015)
Weight at weaning (kg)	Benin	4.50±0.90	Youssao *et al*. (2009a)
	Ghana	6.20±0.90	Abdul-Rahman *et al*. (2016)
		5.70±1.20	Darfour-Oduro *et al*. (2009)
	Nigeria	3.80	Aladi *et al*. (2008)
		5.10-6.00	Oluwole and Omitogun (2015)
		4.00	Ajayi and Akinokun (2013)
Age at weaning (days)	Benin	61.90±8.80	Youssao *et al*. (2009a)
		50.30±2.40	Koutinhouin *et al*. (2009)
		52.67±2.00*	
	Nigeria	40.90±7.50	Aladi *et al*. (2008)

* data reported in traditional method

d'Ivoire in 2008 (Tra Bi Tra, 2009) and in Benin in 2015 (Youssao, 2015). In Nigeria, following work on conditions and benefits of this biotechnology introduction in pig farms in 1977 (Dede and Steinbach, 1977). it was introduced in the 2000s and sows were inseminated in farms and research centers for zootechnical performances improvement in local pigs (Ugwu *et al*., 2009; Oniku *et al*., 2014). It is most of the time used to facilitate animal selection and crossbreeding programs in genetic improvement schemes. This is the case in Nigeria where it was used in the genetic improvement program of local pig by crossbreeding with exotic pigs (Ugwu *et al*., 2009). Performances improvement of pigs through artificial insemination in Côte d'Ivoire really began in 2012 and sows were inseminated with fresh semen (refrigerate at 17°C) from exotic pigs from France (Bitty, 2014). Following these inseminations, reproductive and growth performances was improved compared to sows mated by local boars on monitored farms (Bitty, 2014). Besides, crossbreedings between local and exotic breeds in Benin (Large White) has improved litter size, birth and weaning weights of animals (Youssao *et al*., 2009b). The genetic program continues today in Benin in pig farms of Ouémé and Plateau departments in the framework of the project on the professionalization of pig chain in Benin where, local sows are inseminated with semen from Landrace and Piétrain boar.

Conclusion

The reproductive performances of local pig is influenced by many factors such as feeding and breeding mode. Their performances is greatly improved by crossbreedings with exotic breeds using artificial insemination. These factors' effect is shown on litter size, birth weight and age at weaning. The influence of other factors remains to be tested on reproductive performances. These factors are those that influence age at puberty, cycle and estrus durations as well as litter size. In addition, many lacking parameters are to be determined or completed in this species: age at puberty of sows and boars, sexual cycle and estrus durations, hormones in the estrus and their levels.

References

Abah, K.O., Itodo, J.I., Ubah, S.A., Shettima, I., 2019. Reproductive performance of pigs raised by intensive management system in Abuja, Nigeria. Vetenary World 12, 305–308.

Abdul-Rahman, I.I., Semaha, P., Yaro, M., 2016. Pre and post-weaning growth performance of Ashanti Black pigs under guinea savanna conditions. Livestock Research for Rural Development, 28 (2): http://www.lrrd.org/lrrd28/2/rahm28014.html

Adebambo, A.O., Dettmers, A.E., 1982. Efficiency of feed and milk utilization by litters pf indigenous and exotic pure and crossbred pigs. Tropical Animal Production 1, 204–208

Agbokounou, M.A., Ahounou, G.S., Youssao, A.K.I., Mensah, G.A., Koutinhouin, G.B., Hornick J.L., 2016. Ethnologie et potentialités du porc local d'Afrique. Journal of Animal and Plant Sciences 29, 4665–4677.

Agbokounou, M.A., Ahounou, G.S., Youssao, A.K.I., Mensah, G.A., Koutinhouin, G.B., Hornick, J.L., 2017a. Effect of cow colostrum on the performance and survival rate of local newborn piglets in Benin Republic. Tropical Animal Health and Production 49, 287–294.

Agbokounou, M.A., Bengaly, Z., Youssao, A.K.I., Mensah, G.A., Koutinhouin, G.B., Hornick, J.L., 2017b. Colostrum immune quality of local sow breed in Benin: Growth, survival and acquisition of passive immunity in new-born piglet. African Journal of Biotechnology 16, 842–851.

Ajayi, B.A., Akinokun, J.O., 2013. Evaluation of some litter traits and heritability estimates of Nigerian Indigenous pigs. International Journal of Applied Agriculture and Apiculture Research 9, 113–119.

Aladi, N.O., Okeudo, N.J., Okoli, I.C., Akanno, E.C., 2008. Reproductive and hematological characteristics of the Nigerian indigenous and large white pigs in a humid tropical environment. Asian Journal of Animal and Veterinary Advances 3, 17–23.

Alenyorege, B., Kodjo, A.K., Addah, W., 2015. Phenotypic Characristics of the Ashanti Black Pig under intensive rearing. Veterinary Science 5, 22–27.

Amills, M., Ramírez, O., Galman-Omitogun, O., Clop, A., 2013. Domestic Pigs in Africa. African Archaeological Review 30, 73–82.

Ayssiwede, S., 2005. L'Insémination Artificielle Porcine: une perspective pour l'amélioration de la productivité des porcs au Bénin. Mémoire de Diplôme d'Etudes Spécialisées en Gestion des ressources animales et végétales en milieux tropicaux, Université de Liège, Faculté Universitaire des Sciences Agronomique de Gembloux, p. 85.

Bidanel, J.-P., Riquet, J., Chardon, P., Hatey, F., Le Roy, P., Milan, D., 2003. Apport des nouvelles biotechnologies aux programmes d'amélioration génétique du porc. Journée de Recherche Porcine 35, 355–368.

Bitty, Z.B.A., 2014. Evaluation de l'efficacité de l'insémination artificielle dans l'amélioration génétique porcine en Côte d'Ivoire. Memoire Master en Production Animal et Développement Durable, Ecole Inter-Etats de Médecine Véterinaire de Dakar, p. 43.

Buldgen, A., Piraux, M., Dieng, A., Schmit, G., Compère, R., 1994. Les élevages de porcs traditionnels du bassin arachidier sénégalais. FAO, http://www.fao.org/ag/AGa/agap/FRG/FEEDback/War/t4

Chiboka, O., 1981. The effect of age at first mating on litter characteristics in the native nigerian pig. Livestock Production Science 8, 155–159.

d'Orgeval Dubouchet, R., 1997. Le développement de l'élevage porcin en Afrique : L'analyse des systèmes d'élevage du porc local africain au Sud-Bénin 78. Institut national agronomique Paris-Grignon, Paris, FRANCE (Université de soutenance), p. 274.

Darfour-Oduro, K.A., Naazie, A., Ahunu, B.K., Aboagye, G.S., 2009. Genetic parameter estimates of growth traits of indigenous pigs in Northern Ghana. Livestock Science 125, 187–191.

Dede, T., Steinbach, J., 1977. Artificial insemination of pigs in Nigeria: A preliminary report. Nigerian Journal of Animal Production 4, 11–108.

Deka, E.K., 2008. Cas de la recherche développement sur la relance du porc local au Bénin. In: 2ème Conférence internationale du réseau « Formation Agricole et Rurale » (FAR),. Tunis, pp. 1-6

Djimenou, D., Adoukonou-Sagbadja, H., Koudande, D.O., Chrysostome, C.A.A.M., Hounzangbe-Adote, S.M., Agbangla, C., 2017. Caractéristiques sociodémographiques des éleveurs de porcs (Sus Scrofa domesticus) et structure du cheptel porcin au Sud du Bénin. International Journal of Biological and Chemical Sciences 11, 2177–2193.

Dotché, O.I., Ahounou, G.S., Salifou, C.F.A., Biobou, R., Kiki, P., Govoeyi, B., Antoine-Moussiaux, N., Dehoux, J.P., Mensah, A.G., Farougou, S., Thilmant, P., Youssao, A.K.I., Koutinhouin, G.B., 2018. Selection and culling criteria for breeding boars and sows in pig farms from Oueme and Plateau departments in Benin. Revue d'élevage et de médecine vétérinaire des pays tropicaux 71, 47–57.

Dotché, O.I., Bankolé, B., Dahouda, M., Biobou, R., Bonou, G.A., Antoine-Moussiaux, N., Dehoux, J.-P., Thilmant, P., Mensah, G.A., Koutinhouin, G.B., Youssao, A.K.I., 2019. Comparison of reproductive performances of local and improved pigs reared in south Benin. Tropical Animal Health and Production 1–12. doi: https://doi.org/10.1007/s11250-019-02058-y

FAO, 2008. Biotechnologie reproductive et moléculaire. In : L'état des ressources zoogénétiques pour l'alimentation et l'agriculture dans le monde (Eds. Rischkowsky B., Pilling D.) FAO, Rome, pp. 287-297.

Helke, K.L., Ezell, P.C., Duran-Struuck, R., Swindle, M.M., 2015. Biology and Diseases of Swine. In: Laboratory Animal Medicine, Third Ed. Elsevier Inc., pp. 695–769.

Holnes, D.H., Chaboeuf, N., 1997. Le porc. Maisonneuve et Larose 15, rue Victor-Cousin, F75005, Paris, pp. 221.

IFIP, 2013. Mémento de l'éleveur du porc. 7ème Ed. IFIP, Paris, p. 364

Ironkwe, M.O., Amefule, K., 2008. Appraisal of indigenous pig procution and management practices in Rivers State, Nigeria. Journal of Agriculture and Social Research 8, 1–7.

Karnuah, A.B., Osei-Amponsah, R., Dunga, G., Wennah, A., Wiles, W.T., Boettcher, P., 2018. Phenotypic characterization of pigs and their production system in Liberia. International Journal of

Livestock Production 9, 175–183.
Kiendrebeogo, T., Mopate Logtene, Y., Kondombo, S.R., Kabore-Zoungrana, C.Y., 2012. Characterization and importance of pig breeds in th e pork industry of the zone of Bobo-Dioulasso (Burkina Faso, West Africa). International Journal of Biological and Chemical Sciences 6, 1535–1547.
Knox, R. V, Wilson, W.D., 2007. Induction of Estrus and Control of the Estrous Cycle in Swine. In: Current Therapy in Large Animal Theriogenology (Eds. YOUNGQUIST R.S., THRELFALL W.R.B.T.-C.T. in L.A.T. (Second E.). W.B. SAUNDERS, Elsevier Saint Louis, pp. 757–764.
Kouamo, J., Tankou, W.F.T., Zoli, A.P., Bah, G.S., Ongla, A.C.N., 2015. Assessment of reproductive and growth performances of pig breeds in the peri-urban area of Douala (Equatorial Zone). Open Veterinary Journal 5, 64–70.
Koutinhouin, G.B., Kpodekon, T.M., Toleba, S.S., Bonou, A.G., Ahounou, G.S., Youssao, A.K.I., Bessanvi, J., 2009. Effet du mode d'élevage sur la prolificité des truies de race locale du Bénin et la viabilité de leurs porcelets, de la naissance au sevrage. International Journal of Biological and Chemical Sciences 3, 819–829.
Leborgne, M.C., Tanguy, J.M., Foisseau, J.M., Selin, I., Vergonzanne, G., Wimmer, E., 2013. Reproduction des animaux d'élevage. 3ème Editi. Paris, p. 466 .
Lesur-Gebremariam, J., 2014. Domestication animale en Afrique. Les Nouvelles de l'archéologie, pp. 120–121, 38–46.
Lucy, M.C., Safranski, T.J., 2017. Heat stress in pregnant sows: Thermal responses and subsequent performance of sows and their offspring. Mol. Reprod. Dev. 84, 946–956.
Meyer, C., 2019. Dictionnaire des Sciences Animales. [On line]. Montpellier, Fr. Cirad.[25/01/2019]
Mezui-Mezui, T., 2000. Maîtrise du début de l'œstrus chez la truie de race locale: Approche endocrinologique, cytologique et mesures du pH 57. École inter-États des sciences et médecine vétérinaires de Dakar, p. 139.
Missohou, A., Niang, M., Foucher, H., Dieye, P.N., 2001. Les systèmes d'élevage porcin en Basse Casamance (Sénégal). Cahier d'agriculture 10, 405–408.
Mopate, L., Kabore-Zoungrana, C., Facho, B., 2011. Structure des troupeaux et performances des élevages porcins de la zone de N'Djaména au Tchad. International Journal of Biological and Chemical Sciences 5, 321–330.
Mopaté, L.Y., Vounparet, Z., Issa Youssouf, A., Kaboré-Zoungrana, C.-Y., 2014. Production practices and constraints of pig farms in NDjamena area, Chad. International Journal of Livestock Production 5, 196–203.
Ndébi, G., Kamajou, J., Ongla, J., 2009. Analyse des contraintes au développement de la production porcine au Cameroun. Tropicultura 27, 70–76.
Nonfon, W.R., 2005. La filière de production du porc local au Bénin: l'amélioration de sa productivité par l'alimentation. Thèse Doctorat en Sciences agronomiques et Ingénierie biologique, Faculté Universitaire des Sciences Agronomiques de Gembloux, Belgique, p. 236.
Nwakpu, P.E., Onu, P.N., 2011. Heterosis for litter size traits in native by two exotic inbred pig crosses. Agriculture and Biology Journal of North America 2, 1340–1346.
Nwakpu, P.E., Onu, P.N., 2007. Utilization of Nigerian Native Pig in Breeding 1. A Genetic Assessment of Crossbred Heterosis in Growth and Litter Size. Research Journal of Animal Sciences 1, 139-145.
Nwakpu, P.E., Ugwu, S.O.C., 2009. Heterosis for litter traits in native by exotic inbred pig crosses. Agro-Science Journal of Tropical Agriculture, Food, Environment and Extension 8, 31–37.
Okeudo, N.J., Aladi, N.O., Okoli, I.C., Akanno, E.C., 2007. Comparative study of the growth and carcass characteristics of the Nigerian Indigenous and Large White Pigs. Asian Journal of Animal Science 1, 57–66.
Okoro, V.M.O., Ogundu, U.E., Udedibie, A.B.I., Okoro, C.L., Ukwu, H.O., Ibe, S.N., 2015. Effect of genotype, sex and parity on growth traits of diallel crossed Nigerian indigenous and exotic pigs. Nigerian Journal of Animal Production 42, 30–41.
Oluwole, O.O., Omitogun, G.O., 2015. Phenotypic evaluation of nigerian indigenous pigs (NIP), its hybrid and backcross for litter and reproductive traits during dry and wet season. International Journal of Innovative Agriculture and Biology Research 3, 11–18.
Oniku, A.C., Bakare, I.A., Shabi, O., 2014. Artificial Insemination (AI) in Swine and New Product Development (NPD): Evidence from Nigeria. International Journal of Sustainable Economies Management 3, 26–38.
Osei-Amponsah, R., Skinner, B.M., Adjei, D.O., Bauer, J., Larson, G., Affara, N.A., Sargent C.A., 2017. Origin and phylogenetic status of the local Ashanti Dwarf pig (ADP) of Ghana based on genetic analysis. BMC Genomics 18, 1–12.
Oseni, S., 2005. Evaluation of the F1 and backcrosses of Nigerian local pigs and the Large White for litter characteristics in Southwest Nigeria. Livestock Research for Rural Development 17 (4). http://www.lrrd.org/lrrd17/4/osen17044.htm
Ossebi, W., Ayssiwede, S.B., Nimbona, F., Malou, R., Djetiin, A.E., Diop, M., Missohou, A., 2018. Obstacles to the development of the pig value chain in Casamance (Senegal): what do actors of the subsector say? Revue d'élevage et de médecine vétérinaire des pays tropicaux 71, 15–22.
Porphyre, V., 2009. Enjeux et contraintes des filières porcines en Afrique de l'Ouest. Grain du sel, pp. 26–27.
Ramírez, O., Ojeda, A., Tomàs, A., Gallardo, D., Huang, L.S., Folch, J.M., Clop, A., Sánchez, A., Badaoui, B., Hanotte, O., Galman-Omitogun, O., Makuza, S.M., Soto H., Cadillo, J., Kelly, L., Cho, I.C., Yeghoyan, S., Pérez-Enciso, M., Amills, M., 2009. Integrating Y-chromosome, mitochondrial, and autosomal data to analyze the origin of pig breeds. Molecular Biology and Evolution 26, 2061–2072.
Ranjit Chandra Sinha A.A.M., Ashis kumar kundu M., Atiqur Rahman M., Islam T., Abdullah-Al Mamun M., 2015. Determination of reproductive parameters of sows at rural areas of Bangladesh. Journal of Advanced Veterinary and Animal Research 2, 74–79.
Suriyasomboon, A., Lundeheim, N., Kunavongkrit, A., Einarsson, S., 2006. Effect of temperature and humidity on reproductive performance of crossbred sows in Thailand. Theriogenology 65, 606–628.
Tra Bi Tra, C., 2009. Filière porcine en Côte d'Ivoire: Production, propositions d'amélioration et perspectives de developpement. Thèse Doctorat Vétérinaire, Ecole Inter-Etat de Médecine Vétérinaire de Dakar, Sénégal, p. 101.
Ugwu, S.O.C., Onyimonyi, A.E., Foleng, H., 2009. Testicular development and relationship between body weight, testis size and sperm output in tropical boars. African Journal of Biotechnology 8, 1165–1169.
Uko, O.J., Ataja, A.M., Babatunde, G.M., 1994. Preliminary study of the incidence of pre-weaning mortality in exotic and West African dwarf pigs in South Nigeria. Revue d'élevage et de médecine vétérinaire des pays tropicaux 47, 329–332.
Williams, A.M., Safranski, T.J., Spiers, D.E., Eichen, P.A., Coate, E.A., Lucy, M.C., 2013. Effects of a controlled heat stress during late gestation, lactation, and after weaning on thermoregulation, metabolism, and reproduction of primiparous sows1. Journal of Animal Science 91, 2700–2714.
Youssao, A.K.I., 2015. Programme national d'amélioration génétique. Projet d'Appui aux Filières Lait et Viande (PAFILAV). PAFILAV, p. 362.
Youssao, A.K.I., Dotché, I.O., Toléba, S.S., Kassa, K., Ahounou, G.S., Salifou, C.F.A., Dahouda, M., Antoine Moussiaux, N., Dehoux, J.P., Mensah, A.G., 2018. Phenotypic characterization of pig genetic resources in the departments of Oueme and Plateau in Benin. Revue d'élevage et de médecine vétérinaire des pays tropicaux 71, 59–65.
Youssao, A.K.I., Koutinhouin, G.B., Kpodekon, T.M., Bonou, A.G., Adjakpa, A., Ahounou, G.S., Mourot, J., 2009a. Performances zootechniques et aptitudes bouchères des porcs locaux au Sud du Bénin. Bulletin of Animal Health and Production in Africa 57, 73–87.
Youssao, A.K.I., Koutinhouin, G.B., Kpodekon, T.M., Bonou, A.G., Adjakpa, A., Dotcho, C.D.G., Atodjinou, F.T.R., 2008. Pig production and Indigenous Genetic Resources in Suburban Areas of Cotonou and Abomey-Calavi in Benin. Revue d'élevage et de médecine vétérinaire des pays tropicaux 61, 235–243.
Youssao, A.K.I., Koutinhouin, G.B., Kpodekon, T.M., Yacoubou, A., Bonou, A.G., Adjakpa, A., Ahounou, G.S., Taiwo, R., 2009b. Amélioration génétique des performances zootechniques du porc local du Bénin par croisement avec le Large White. International Journal of Biological and Chemical Sciences 3, 653–662.