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Characterization and Rearing Practices of Philippine Native Pigs at San Mariano, Isabela

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Abstract

Aim: Native animals depend on their unique phenotypic and genetic characteristics to adapt to their environment and the conditions of small-scale farms. This study, conducted in San Mariano, Isabela, aimed to understand the profiles and rearing practices of native pig farmers for a sustainable industry.

Methodology: The study made use of a descriptive survey method. Data on the demographic profile, production practices, and challenges in raising native pigs of the native pig's raisers were gathered using a structured questionnaire and were reviewed using the Cronbach reliability test during the visit through face-to-face interviews. The phenotypic character and reproductive performance of the native pigs were collected through observation and measurements.

Results: In San Mariano, Isabela, the majority of native pig raisers (31-50 years old, female, married, Roman Catholic, with elementary education) depended on farming as their primary income source, having less than five years of experience in native pig production. Native pigs, mainly females (gilts and sows) aged 6 to 8 months, exhibited black color, straight dense hair, and docile behavior. Morphometric measurements indicated variations between genders, with females being heavier. Breeding practices, farrowing patterns, and reproductive performance were documented, highlighting breeding at specific ages, mating intervals, and litter sizes. Native pigs were raised for both food and income, employing tethering and semi-confinement systems, with locally-made housing. Feeding involved wet food with ad libitum water supply and a mixture of farm by-products and commercially pelleted feeds. Challenges faced by raisers included limited veterinary access, escalating feed costs, and various production issues.

Conclusion: Based on the results of the study, there are many native pig raisers in the municipality of San Mariano, Isabela. Mature native pigs were generally black with plain color and had straight snouts and head profiles with semi-lop ears. Sexual dimorphism was observed wherein females were heavier and longer than males. Most of the farmers rear their pigs in the traditional system of raising and use readily available farm by-products as feeds. Native pig raising in the locality is limited by lack of access to veterinary services and others. Traits related to native pigs were due to inbreeding since native pig raisers obtained their stocks within the locality.

Keywords: *farming, native pigs, breeding practices, tethering, semi-confinement, morphometry, farrowing*

INTRODUCTION

Agriculture is one of the major sectors that play an important role in the Philippine economy besides forestry and fishing involving 40% of Filipino workers. From the total agricultural output, livestock and poultry production contributed a total of 12.7% (FAO, 2022) which consisted of carabao, cattle, goat, swine, chicken, and duck. Of all the animals reared for human consumption, hogs and chickens are the most consumed, but with the unprecedented ASF outbreaks occurring around many countries, animal health, welfare, agricultural economy, and food security are severely affected (Costard *et al.*, 2009; FAO, 2020; Tian and von Cramon-Taubadel, 2020).

The Philippines is rich in biological and genetic resources or biodiversity. The majority of plant and animal species in the country are unique and cannot be found anywhere else (PDP 2011-2016 and NEDA, 2011). Its population

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is made up of several breeds and genetic groups that are distributed throughout the country and in different farm types that practice different production systems. The genetic resources of pigs in the country are highly diverse and are classified into exotic standard purebreds, synthetic hybrids, Philippine wild pigs (black), and Philippine native pigs (Oh *et al.*, 2014).

Pigs serve as the major source of protein for Filipinos, as it provide about 60.0% of the total animal meat consumption in the country (DOST-PCAARRD, 2016). In 2017, the Philippine pig industry contributed significantly to the world's pig production; it ranked as the third top producer in Asia, and eighth in the world. It is also the second largest contributor to the total value of agricultural production in the country, contributing 18.28%, with a gross value of 3.80 billion dollars at current prices.

The first domestication of pigs was in the Near East between 8,500 and 8,000 BC. (Caliebe *et. al.*, 2017). In the Philippines, it is believed that domestic pigs were introduced around 4,000 years ago when Chinese migrants brought them via Taiwan and the Spaniard's influence during the Spanish era (Bondoc, 2008a; Piper *et. al.*, 2009). Therefore, the word *'native'* was used as early as 1980 (Bondoc 2008a; Basilio 2016; Dichoso *et al.*, 2022) pertaining to the adaptability of the animals to local conditions and their important sociocultural role, rather than its evolutionary context.

Through the years of domestication and with the influence of exotic breeds, the native pigs were considered mongrels and had varied characteristics depending on the region where they were found (Baguio, 2017). The swine genetic group present in the country is classified into exotic standard pure breeds, synthetic hybrids, Philippine wild pigs, and Philippine native pigs and their crosses or upgraded breeds (Status of the Philippine Animal Genetic Resources (A Country Report 2003). Varieties of Philippine native pigs include the following Ilocos, Jalajala with black, or a combination of black with a white belly.

Native pigs in the Philippines are thought to have descended from wild pigs like *Sus nehring* of Luzon, *Celebensis philippinensis, Sus sanborn* of the Negros Island, *Celebensis negrinus*, and *Sus barbatus* in Palawan (Bondoc, 2008). True native and endemic pigs in the Philippines are referred to as wild pigs *Sus philippensis, S. cebifrons, S. oliveri, and S. ahoenobarbus* (Heaney *et al.*, 2020; Ingicco *et al.,* 2017; Lucchini *et al.,* 2005; Groves 2013).

A Philippine native pig is described as either black or black with a white belly, lop to semi-lop ear (ears that droop or hang down nearly covering the eyes) and straight back and predominantly black, had long snout, and small, erect ears. They are alert and nervous in temperament (Philippine Native Animal Development Act of 2019; Santiago *et al.*, 2016; Monleon, 2005).

Geromo (1993) described native pigs of Zamboanga Peninsula with black as the most prevalent coat color pattern varied from pure black to spotted black and white, and striped coat color patterns with dark brown and red spot mixture were also commonly observed. Geromo *et al.*,(2020) also found similar findings in the native pigs in Bohol Island Philippines which have predominantly (73%) black hair with color patterns of plain color (91%), spotted (4%), and patchy (5%). Layos *et al.,* (2018) also found that the majority of coat color was black on native pigs in Panay and Guimaras Island, Romblon (Falculan, 2021) and Batanes, Quezon, Marinduque, (Dichoso *et al.*, 2022). Native pigs in selected municipalities of Isabela Province have a dominant coat color pattern of black (90.48%), few light red (4.76%), and white (4.76%) colors while the majority of the color pattern was plain black (83.33%), patchy (9.53%) and spotted (7.14%) (Cauilan, 2023).

As such, the Congress of the Philippines has passed a local legislation (Senate Bill 821 also known as the Philippine Native Animal Development Act of 2019) that promotes their conservation and development. This bill defines native animals as "breeds of chickens, pigs, cattle, goats, sheep, ducks, and other domesticated farm animals that are more adapted to the environmental conditions of the Philippines, having emerged through a long process of natural selection". Hence, this study was conducted aimed at understanding the profiles and rearing practices of native pig farmers for a sustainable industry.

Methodology

Materials

Ball point pens and printed structured questionnaires were used and reviewed using Cronbach alpha for reliability test during the face-to-face interview on the respondents. Likewise, smart phones were used for capturing images of native pig and geo-tagging. For morphometric traits, a textile measuring tape was used for the linear

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measurements of body length, head length, tail length, ear length, chest girth, and height at withers, following the checklist for the phenotyping of pigs (FAO 2012).

Study Area

The study was conducted at five (5) native pig raising barangays of the municipality of San Mariano, Isabela namely Old San Mariano, Minanga, Panninan, Gangalan, and Ibujan. San Mariano is a coastal municipality in the province of Isabela. The municipality has a land area of 1,459.16 square kilometers or 563.38 square miles which constitutes 11.14% of Isabela's total land area. The town has 36 barangays and recent data reports that there are 123 raisers of native pigs in the municipality as per the Municipal Agricultural Office of San Mariano, Isabela.

Study Population

All the native gilts/sow and/or boar raised by the 123 native pig raisers in the municipality were included in the study. Data on the demographic profile, production practices and performance and challenges in the raising of native pigs were collected using a structured questionnaire during the visit through face-to-face interview. Coordination with the Municipal Agriculturists and Barangay Captains was sought prior to the conduct of the study.

Ethical Considerations

The study protocol did not include collection of sensitive individual information and consents were asked verbally. All interviewees were informed about the research objectives and type of questions before the start of the interview, as well as about their right to decline participation, interrupt, or withdraw from the conversation at any time. Anonymity and confidentiality of participants' information were guaranteed by ensuring that the information provided was anonymized.

Study Design and Sampling

All the gilts/sow and/or boar raised by the 123 native pig raisers in the municipality were included in the study. Upon arrival at the farm, the family member responsible for native pig rearing was selected for the interview. Other inclusion criteria for the selection of respondents include proper communication skills and age should be 18 years old or older. Data on the questionnaire was compiled in a spreadsheet program (Microsoft Excel© 2010). Descriptive analysis was generated from the farmer's demography, management practices and phenotypic characteristics using frequency distributions and measures of central tendency. Standard Deviation (SD) were used to calculate the morphological characterization of native pigs.

Data Gathered

The following data was determined and recorded.

1. **Demographic profile.** Data on demographic profile were recorded and collated using structured questionnaires through face-to-face interview with the native pig raisers

2. Phenotypic Characterization.

Phenotypic Characterization. Qualitative traits such as the age at characterization, sex, dominant color (black, dark red, light red, spotted), coat color (plain, patchy or spotted), hair type (curly or straight), hair distribution (dense or sparse), presence or absence of tusk in boars, shape of snout (curve or straight), shaped of the head (concave, convex or straight), ear type (droopy, semi-lop or erect), ear orientation (forward, backward or upward), skin type (smooth or wrinkled), tail type (straight or curly), backline conformation (straight or swayed back) and temperament (docile, aggressive or afraid) were visually observed and categorized.

Quantitative traits were measured using a tape measure following the guidelines of FAO (2012) on phenotypic characterization of animal genetic resources. These traits included hair length (longest hair is located at the wither hence 3 hairs were plucked of in 3 areas of the wither), snout length was measured at the level of the base of the medial canthus of the eye to the tip of the nose or rostrum, head length was measured from the base of the ear to the

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tip of the nose, width of the forehead was measured at the level between the base of the left and right ear, ear length was measured from the base to the tip, body length was measured on the mid lateral side of the animal from the cranial border of the scapula to the caudal tip of the rump, the heart girth was measured by taking the circumference of the thorax at the level immediately caudal to the elbow joint, the mid-body girth was measured by taking the circumference of the abdomen at the level of the umbilicus, the rump girth was measured by taking the circumference of the abdomen at the area cranial to the stifle joint, height at wither was measured from the tip of the shoulder to distal end of the hoof, height at rump was measured from the tip of the hip joint to distal end of the hoof, circumference of the hock was measured, the tail length was measured from the base to the tip of the fully stretched tail, and teat number both from left and right was obtained through palpation.

a. Body Weight Estimates for Native Pigs. The body weights of the native pigs were recorded and estimated using the following formula (Javier, 2001):

$$\frac{\text{Hearth girth}^2\text{ (inch) x body length (inch)}}{400\text{ lbs}} = \frac{\text{Body weight (lbs)}}{2.2\text{ kg}} = \text{BW (kg)}$$

This formula was accurate within 3% (Pig site, 2002) and has been cited by the Canadian Journal of Animal Science. However, it was used to estimate body weights of modern pigs.

3. Reproductive Performance. Sows with at least two farrowing's from the date of interview were included in the study. Data on litter size (LS), number of live-born piglets (NLP), age at first mating, age at first farrowing, interval between farrowing, and number of piglets weaned were obtained through current inventory and recall of the native pig raiser.

4. Production system. The production system was evaluated through observation and questions on the type of housing and management system, feeds offered and frequency of feeding, and care and management for sick pigs.

5. Geotagging. During the interview, the coordinates of the farms where the pens were located were documented using the Google Map® application. The data on the longitude and latitude coordinates in the area were recorded in the survey form. After which, the tagged locations were laid -out and accessed through the application.

Results and Discussions

1. Socio-Demographic Profiles of the Native Pig Raisers. As presented in Table 1, Majority of the native pig raisers in the municipality of San Mariano belong to the age bracket of 31-50 years old with 50.41 percent (62); 26.83 percent (33) fell in the age group 15-30 years old; 16.26 percent (20) were aged 51-65 years old and 6.50 percent (8) from age 66 and above. This coincided with the study of Mesia (2018), who reported that the mean age of farmers who raise native pigs is 43.47 with the youngest, 25 years old, and oldest, years old in Western Pangasinan. Moreover, Villanueva & Sulabo (2018) claim that most native raisers in the country were from 20 to 61 years old and above.

As to the sex profile of native pig raisers, most of them were female with a percentage of 56.91 (70) while there were only 43.09 percent (53). This implies that most native pig raisers in the locality of San Mariano most of them are female compared than male. Similar findings were reported by Mesia (2018), in Western Pangasinan where most of the raisers were females because male farmers work in the fields. However, the result of this study is in contrast to the reports of Villanueva and Sulabo (2018), who reported that most of the native pig raisers in the country were males in productive age which was attributed to the fact that swine raising requires labor, and hard work.

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Table 1. Socio-Demographic Profile of Native Pig Raisers in Selected Barangays at San Mariano, Isabela

Parameter		Frequency	Percentage (%)
Age	15-30	33	26.83
	31-50	62	50.41
	51-65	20	16.26
	66 and above	8	6.50
Sex	Male	53	43.09
	Female	70	56.91
Civil Status	Single	11	8.94
	Married	108	87.81
	Separated	1	0.81
	Widowed	3	2.44
Religion	Roman Catholic	123	100.00
Educational Attainment	Elementary Level	54	43.90
	High School Level	26	21.14
	High School Graduate	11	8.94
	College Level	22	17.89
	College Graduate	10	8.13
Occupation	Farming	82	66.67
	Housewife	41	33.33
Dialect Spoken	Ilocano	73	63.16
	Ybanag	50	36.84
Years in Raising Native Pig	5 and below	65	52.85
	6-10 years	35	28.46
	11-15 years	10	8.13
	16-20 years	8	6.50
	21 and above	5	4.06

Cauilan (2023), reported that most of the native pig raisers in selected municipalities were female (67.46%) and only a few males (32.54%) except in the municipality of City of Ilagan, Isabela where the majority of raisers were males (51.79%). As to age group and civil status, most of the native pig raisers had an age range from 31-50 years old (54.07%), and 89.00% were married (Cauilan, 2023).

In terms of civil status, 87.81% (108) were married; followed by single and had an average of 8.94 percent (11), widowed with 2.44 percent (3), and 0.81 percent (1) were separated in this study.

As to religious affiliation, one hundred percent of the native pig raisers in the locality of San Mariano, Isabela are Roman Catholic with 100 percent (123).

In terms of educational attainment, the majority of them are elementary level at 43.90 percent (54), followed by the high school level and had a 21.87 percent (26), 17.89 percent (22) of them are college level; 8.94 percent (11) are high school graduates and 8.13 percent (10) are college graduates. Most of the native pig raisers' livelihood is farming with 66.67 percent (82) and 33.33 percent (41) being housewives. A proportion of 63.16 percent (73) speak Ilocano while 36.84 percent (50) are Ybanag. Similar results were reported by Cauilan (2023), where the dialect spoken in selected municipalities of Isabela Province is Ilocano (81.82%).

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The majority of the respondents were raising native pigs not longer than five years 52.85 percent (65); followed by 28.46 percent (35) with 6-10 years' experience, 8.13 percent (10) with 11-15 years of experience, 6.50 percent (8) with 16-20 years experience, and 4.06 percent (5) with 21 or more years of experience. This suggests that native pig raising has been a backyard enterprise in the town of San Mariano, Isabela, and has become a source of income among the members of rural communities which coincides with the claims of Villanueva and Sulabo (2018) that native pig production in the country is a traditional enterprise of farmers.

Phenotypic Characterization of Native Pigs in San Mariano, Isabela.
Qualitative Traits.

Presented in Table 2 is the qualitative phenotypic profile of the gilt, sow and boar native pigs in San Mariano, Isabela.

The native pig population in the municipality was predominantly female with 86.40 percent (108) and only 13.60 percent (17) were males. These findings may reflect a promising/continuous supply of native pig population in the locality since there are more female breeder animals than males.

As to the age of native pigs surveyed, 52.80 percent (66) of the native pigs were 1-3 years old; followed by 6-8 months old with 32.00 percent (40), and the least number of populations based on age were noted in 9-11 months with 15.20 percent (19). Mason (1996) reported that gilts exhibit signs of sexual maturity as young as 4 to 5 months. Native pigs were sexually mature at a mean age of 5.79 months. The findings in this study imply that in the municipality of San Mariano, there are female native pigs that are ready to be bred.

Based on the actual and subjective observation and characterization, 86.40 percent (108) of the native pigs in San Mariano, Isabela were black-colored other combinations of colors include spotted with 9.60 percent (12) and fawn with 4.00 percent (5), respectively. This coincided with the study of Layos *et al.* (2018) who reported black as the predominant color among the native pigs in the Philippines. Some have also a combination of black with a white color pattern on the belly, tail, and feet, and white patches on the forehead and face. On the other hand, Cauilan (2023) also reported that the predominant coat color of native pigs in Isabela Province was black while some were light red and white.

Mason (1996) confirmed that Philippine native pigs were either totally black or had black-colored bodies with occasionally white-colored bellies and red markings, and Navarra (1996), also documented the phenotype of Philippine native pigs (*Sus scrofa* L.) are black with white spots on the face, hocks and tail and rust-brown to light-brown in color.

The dominant coat color pattern recorded is plain with 88 percent (110); spotted with 10.40 percent (13) and patchy coat colors of 1.60 percent (2). Geromo (2020) reported that the dominant coat color pattern of native pigs in Bohol Island, Philippines recorded as plain with a combination of patchy and spotted. The dominant coat color pattern of native pigs was the product of genetic mutation of other breeds from other countries which was found in Western and Chinese pigs (Kijas *et al.* 1998, 2001; Fang *et al.* 2009).

In terms of hair and hair density, most of the native pigs had straight hair at 99.20 percent (124) and dense hair at 88.00 percent (110), a small portion of native pigs had curly hair at 0.80 percent (1) and some had sparse hair with 12.00 percent (15). The same results were observed in selected municipalities of Isabela Province with hair densities of equally dense and sparse (Cauilan, 2023).

Table 2. Qualitative Phenotypic Profiles of Mature Native Pig in San Mariano, Isabela

Parameters		Frequency n=125	Percentage (%)
Sex of Native Pig	Female	108	86.40
	Male	17	13.60
Age	6-8 Months	40	32.00
	9-11 Months	19	15.20
	1-3 Years	66	52.80
Dominant Color	Black	108	86.40
	Spotted	12	9.60

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	Fawn	5	4.00
Coat Color Pattern	Plain	110	88.00
	Patchy	2	1.60
	Spotted	13	10.40
Hair	Curly	1	0.80
	Straight	124	99.20
Density	Dense	110	88.00
	Sparse	15	12.00
Tusk	Present	-	-
	Absent	125	100.00
Snout	Curve	27	21.60
	Straight	98	78.40
Head	Concave	45	36.00
	Convex	3	2.40
	Straight	77	61.60
Ear	Droopy	32	25.60
	Semi-loop	61	48.80
	Erect	32	25.60
Skin	Smooth	118	94.40
	Wrinkled	7	5.60
Tail	Straight	107	85.60
	Curly	18	14.40
Backline	Straight	113	90.40
	Swayback	12	9.60
Behavior	Docile	101	80.80
	Aggressive	7	5.60
	Afraid	17	13.60

All the boars do not have tusks: 100 percent (125). Zheng *et al.,* (2023) confirmed that the tusk of wild boars is used to dig the soil and serve as a defense mechanism and was degraded during the life cycle of wild boars. However, according to Peñalba (1993), mature boars have large and prominent tusks. Falculan (2021) reported that the presence of tusks in boar has only been observed in Tablas Island of Romblon Province. On the contrary, Cauilan (2023) observed that boars in selected municipalities of Isabela Province had no tusk.

The majority of the native pigs had straight snouts with 78.40 percent (98) while 21.60 percent (27) had curved. The head shape was predominantly straight with 61.60 percent (77); followed by concave a 36.00 percent (45) and convex at 2.40 percent (3). Santiago *et al.*, (2016) described native pigs as having long snout and straight heads. These data coincided with the study of Falculan (2021) who reported that native pigs in the Zamboanga Peninsula and the Province of Romblon have predominantly long snouts. On the other hand, Dichoso *et al.*, (2022) observed that the majority of the Philippine native pigs had short cylindrical snout and straight heads.

In terms of ear orientation, most of the native pigs had semi-loop ears at 48.80 percent (61); followed by droopy ears, at 25.60 percent (32), and erect ears at 25.60 percent (32). This finding is contrary to the study of Yaetsu *et al.*, (2009), who reported that erect ears were common among native pigs in different regions of Bangladesh. However, some of the native pig breeds in other countries such as Taihu and Meishan in China and large Black from Australia also exhibit drooping ears (The Pig Site, 2013). Subalini *et al.* (2010), reported that village pigs could have

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droopy ears as well. However, the majority of the Philippine native pigs in Luzon, from Batanes, Quezon, and Marinduque had erect and forward-oriented ears (Dichoso *et al.*, 2022). In Romblon Philippines, most of the native pigs have droopy ears (Falculan, 2021). The native pigs also revealed droopy (54%), slightly droopy (37%), and erect (9%) ear orientations in Bohol Island Philippines (Geromo *et al.*, (2020). Native pigs developed in the Provinces of Isabela, Marinduque, Eastern Samar, Benguet, and Kalinga have erect ears while native pigs from Quezon Province (Q-black) have semi-lop ears (https://pab-is.pcaarrd.dost.gov.ph/nativepigs/#breeds). Moreover, the ear orientation of native pigs in Isabela Province had forward ear orientation (69.41%); 16.47% upward, and 14.12% backward ear orientation (Cauilan, 2023).

As to skin characteristics, the majority of the native pigs in San Mariano, Isabela have smooth skin of 94.40 percent (118) while 5.60 percent (7) have wrinkled skin. Similar results were observed in Isabela Province as to skin type wherein 91.76% had smooth skin while 8.74% had wrinkled skin type. Wrinkled skin type was particularly observed in the native pigs from the Municipality of Benito Soliven and Jones, Isabela, respectively (Cauilan, 2023).

As to tail and backline, the majority of the native pigs revealed straight tail and backline at 85.60 percent (107) and 90.40 (113) respectively. Yaetsu *et al.*, (2009), reported that native pigs in Bangladesh have concave backs and pendulous bellies with a straight tail. These findings were similar to the study of Dichoso *et al.,* (2022), who reported native pigs having straight tails and straight backlines.

During the characterization, most of the native pigs were docile about 80.80 percent (101); 13.60 percent (17) were afraid and 5.60 percent (7) were aggressive. Cauilan (2023), reported that the majority of the native pigs in selected municipalities of Isabela Province exhibited docile behavior (69.38%); 19.62% exhibited afraid behavior while 11.00% showed aggressive behavior.

Additionally, it was observed also that those animals that exhibited afraid and aggressive behavior had minimal contact with humans and some raisers tend to avoid contact with their animals as they are afraid to be attacked by them (Cauilan, 2023).

Quantitative Traits. The morphometry of the matured native pigs in the study is shown in Table 3.

Body weight as a quantitative trait is influenced by both genotype and environment. Other factors such as directional selective breeding, may contribute in making variations in body size and weight (Jones, 1998). Using the formula of Javier (2001), the body weight of the native pigs in San Mariano, Isabela is 39.15+23.26kg. Female native pigs were observed to be heavier with an average weight of 43.20+31.33 kg compared to the males at 39.58+ 14.59 kg. Geromo (2020) reported that female native pigs had a higher body weight of 72.89+38.31 kg compared to males which is 47.44+45.52 kg, respectively. The findings also coincided with the study of Falculan (2021) who reported that female native pigs in Romblon Province were heavier at 54.29 kg and 49.58 kg than the males which accounted for differences in feeding management of native pig raisers in Romblon, Province. However, in the investigation of Tyasi *et al.* (2015), morphological measurements such as heart girth, shoulder height, and body length are useful for estimating and predicting body weight in Kolbroek and Large White pigs. Moreover, path analysis needs to be done on native pigs to find out which body measurement traits, directly and indirectly, affect body weight. Thus, can help pig farmers in the selection of pigs for breeding purposes. It is well concluded that there are factors that affect the growth performance of indigenous, as well as exotic pigs.

The snout length of the native pigs ranged from 10-24 cm with an average of 15.69+2.73 cm. In terms of their head length and width of the forehead, a 12-35 cm and 10-24 cm range were recorded with an average length of 25.22+4.01 and 13.90 +2.09, respectively. Cauilan (2023) reported that native pigs in selected municipalities in the Province of Isabela had a snout length of 14.53+0.47 cm and a shorter snout length was found in the municipality of Benito Soliven and the longest snout was found in the City of Ilagan, Isabela.

The ear length of the native pigs recorded in this study was 19.3+4.05 cm which was longer as compared to the report of Falculan (2021) in Romblon Province of an ear length of 13.99 cm. The results of this study in terms of the length of the ears fall within the range reported by Cauilan (2023) in Isabela Province ranging from 12.03+1.25 cm to 21.00+1.25 cm.

The body length of native pigs was at 50-110 cm with a mean of 75.74 +14.12 and it was observed during characterization that females had a longer body length of 67.53+10.52 compared to males with 59.50+7.23. Layos *et al.*, (2018) claimed that based on sex, the female had a longer body (74.06+11.32 cm) than male native pigs (68.06+ 13.30 cm). Likewise, heart girth measured was 44-149 cm with a mean of 80.43 +17.04. The study of Javier (2001) revealed that Philippine native pigs had an average heart girth of 27.66 inches (70.26 cm): males having an

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average of 26.05 inches (67.31 cm) and females, 28.03 inches (71.20 cm). Native pigs in San Mariano, Isabela had an average tail length of 24.05cm +5.73, respectively. Geromo (2020), reported that the tail length of native pigs in Bohol Island Philippines was longer in female native pigs compared to male native pigs.

The mid-body girth and rump girth had an average of 90.70+19.32 cm and 83.21+18.63 cm, respectively. Pelvic widths measured at about 17.31+4.67 cm. The height at wither had a mean height of 56.2 +10.06 cm and at rump height of 59.73+10.06 cm. Both males and females have almost the same height measurement. Caulian (2023) revealed that pigs in the municipality of Roxas and the City of Ilagan had bigger mid-girth measurements with a mean of 96.45+2.41 cm, compared to the native pigs from other selected municipalities of Isabela Province. As to rump girth measurements native pigs from municipalities of Roxas and the City of Ilagan, Isabela recorded a rump girth ranging from 84.56+1.96 cm to 98.38+1.96 cm and pelvic width of 17.50+0.53 cm observed in the municipalities of Angadanan and City of Ilagan, Isabela, respectively (Caulian, 2023). Falculan (2021), reported that longer height, length of the body, tail, and ear, as well as the circumference of the heart and mid girth were attributed to heavier weights of native pigs.

The left hock circumference of native pigs was 15.16 cm +2.54. The majority of the native pigs in San Mariano, Isabela had 6 pairs of teats. These findings were similar to the study of Loffler (1991) who characterized pigs as having six to eight pairs of teats. It also coincided with Schmidt (1936) and Kurosawa *et al.*, (1978) explained that in the wild pig, animals with eight or twelve teats also occur, but the most frequent was ten teats (5 pairs) and the number of teats is dependent on domestication from wild boar to domesticated pig. Hair length recorded ranged from 1-9 cm.

Table 3. Morphometry of Mature Native Pig in San Mariano, Isabela (Mean + SD)

Parameters	**Mean**
Body Weight (kg)	39.15+23.26
Female Body Weight (kg)	43.20+31.33
Male Body Weight (kg)	39.58+14.59
Snout Length (cm)	15.69+2.73
Head Length (cm)	25.22+4.01
Forehead Width (cm)	13.90+2.09
Ear Length (Left) (cm)	19.16+4.05
Body Length (cm)	75.74+14.12
Female Body Length (cm)	67.53+10.52
Male Body Length (cm)	59.50+7.23
Heart Girth(cm)	80.43+17.04
Mid-body Girth(cm)	90.70+19.32
Rump Girth (cm)	83.21+18.63
Pelvic Width (cm)	17.31+4.67
Tail Length (cm)	24.05+5.73
Height at Wither (cm)	56.22+10.06

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Height at Rump (cm)	59.73+10.08
Hock Circumference (Left) (cm)	15.16+2.54
Teat Number (Left) (cm)	6.10+0.77
Teat Number (Right) (cm)	6.09+0.77
Hair Measurement-Cranial (cm)	3.06+0.82
Hair-Mid(cm)	4.26+1.01
Hair-Caudal (cm)	5.51+1.29

Reproductive Performance of Native Pigs

The reproductive performance of the native pigs in the municipality of San Mariano, Isabela is shown in Table 4.

Most of the sows were observed to farrow during July-September with 48.75 percent (39); followed by January to March, 41.25 percent (33); April-June, 6.25 percent (5) and least farrowed during October to December with 3.75 percent (3).

Most of the native pig raisers breed their sows by bringing the boar to the show with an average of 86.25 percent (69) when estrus is observed while others take their sows to the boar of about 13.75% (11). In addition, most farmers do not own a boar, 97.50 percent (78). Hence, native raisers pay for boar services with (1) weanling piglet or cash. These findings may imply that native pig raisers in the locality of San Mariano, Isabela rely on breeders outside their herd for their animals.

Table 4. Reproductive Performance of the Native Pig in San Mariano, Isabela.

Parameters		**Frequency n=80 (sows)**	**Percentages (%)**
Months Most Farrowed	January-March	33	41.25
	April-June	5	6.25
	July-September	39	48.75
	October-December	3	3.75
Best Months for Farrowing	January-March	15	18.75
	April-June	34	42.50
	July-September	24	30.00
	October-December	7	8.75
System of Mating	Sow taken to boar	11	13.75
	Boar brought to sow	69	86.25
Own Boar	Yes	2	2.50
	No	78	97.50
Pay for Service of Boar	Yes	78	97.50

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	No	2	2.50

Sows or gilts are bred for the first time at the age of 7.75+1.12 months while males are used for breeding at 11.84+2.33 months. Mason (1996) described the Philippine native pigs as very prolific with female pigs observed to become sexually mature at an average of 5.79 months with values ranging from 4-8 months (Penalba, 1993); gilts exhibit signs of sexual maturity as young as 4 to 5 months while Geromo (1993) reported that sexual maturity in female native pigs occurred at 7.11 months. Furthermore, Geromo (1993) reported that the age at first farrowing occurs at 11.73 months while Bondoc *et al.* (2017) reported the average first farrowing at 21.6+ 1.3 months for black Tiaong pigs and 15.8+1.4 months for Kalinga native pigs. Moreover, Xayalath & Ratky (2021) reported that the pubertal age of Black Tiaong and Kalinga is at 5.55 months for males and 5.95 months (for females). As to age at first mating, an average of 9.15 months and a length of estrus of 20.83 days were reported by Xayalath & Ratky (2021). In addition, previous studies reveal that the occurrence of puberty was at 254.5 days (Sinha, 2012) and higher than that of Sterling *et al.,* (1998) & Tummaruk *et al.,* (2003) as cited by Motaleb *et al.* (2014) where the age at puberty ranged from 204 to 206 days.

Table 4. Reproductive Performance of Native Pigs in San Mariano, Isabela.

Parameters	**Mean+SD**
Age of gilt/sow at First Mating (Months)	7.75+1.12
Age of Boar at First Mating (Months)	11.84+2.33
Average Litter Size (Heads)	5.98+1.01
Mating Interval between Farrowing (Months)	3.83+0.95
No. of Piglets Born Alive (heads)	7.03+1.50
Number of Piglets Weaned (Heads)	6.95+1.26

The average litter size of sows was at an average of 5.98+1.01. The average litter size at birth ranges from 3.54 piglets for Yookah®, 5.22-8.4 (Peñalba, 1993), 5.71+0.19 from black Tiaong sow's and 5.1+0.41from Kalinga sow's (Bondoc *et. al.*, 2017), 5.35 piglets from Sinirangan®, 6.42 piglets from Q-Black, 8.17 piglets from Benguet native pig, 7.70 piglets from ISUbela®, and 7.23 from Markaduke® https://pab-is.pcaarrd.dost.gov.ph/nativepigs/#breeds, 8.12 piglets (Geromo, 1993), 10 piglets (Bondoc and Ramos, 1995). Moreover, Cauilan (2023) reported that native pigs from selected municipalities in Isabela had an average mean of 6.91+0.42 piglets.

In terms of farrowing intervals of sows, a mean of 3.83+0.95 or an interval of 2-5 succession was observed. Values of different performance parameters in the present study are comparable to the observations made by Sahaayaruban *et al.*(1983) and Goonewardena *et al.*, (1984) as cited by Subalini *et al.*(2010) in their phenotypic characterization and production performance of village pigs in Sri Lanka. For instance, gestation length varied from 108 to 118 days. In addition, previous studies reveal that the occurrence of puberty was at 254.5 days (Sinha, 2012) and higher than that of Sterling *et al.* (1998) & Tummaruk *et al.* (2003) as cited by Motaleb *et al.,* (2014) where the age at puberty was 204 to 206 days. The variations at the age of puberty among different studies may be due to differences in environment, feeding, and management practices.

The mean number of piglets born alive is 7.03+1.50 heads while piglets weaned is at 6.93+1.26 heads. The pre-weaning mortality of piglets was due to scouring (diarrhea), and climatic conditions in the area and it was found out also during the interview that some sows were aggressive. Mastitis or no milk after parturition was recorded as one of the problems by native pig raisers in San Mariano, Isabela.

Production System. The production system of native pig at San Mariano, Isabela is presented in Table 5.

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Predominantly, majority of the native pig raisers in San Mariano, Isabela practice the traditional system of native pig raising. Raisers tend to engage in native pig production for food and sell the pigs on a live-weight basis or slaughter with an average 98.40 percent (123) to be sold in rural communities. In contrast, Geromo (2020) reported that most native pig raisers rear native pigs for food and special occasions. Raising livestock is also practiced in addition to planting field crops. Backyard farming has very low resources of labor and capital. Often, farmers in rural areas depend only on farming as their source of income (FAO-UNESCO, 2002).

Table 5. Production System of Native Pig at San Mariano, Isabela

Parameters		**Frequency n=125**	**Percentage (%)**
Reason for Raising	For sale of pig and products	2	1.60
	Both	123	98.40
System of Raising	Complete Confinement	31	24.80
	Semi Confinement	3	2.40
	Range with Shelter	1	0.80
	Range without Shelter	2	1.60
	Tethering	88	70.40
Materials for Walls	Natural	117	93.60
	Commercial	8	6.40
Roofing Materials	Natural	98	78.40
	Commercial	27	21.60
Fencing Materials	Natural	121	96.80
	Commercial	4	3.20
Flooring Materials	Soil	90	72.00
	Concrete	35	28.00
Frequency of Feeding	Twice a day	13	10.40
	Thrice a day	112	89.60
Type of Feed Given	Commercial	119	95.20
	Farm Products	99	79.20
	Farm by products	122	97.60
	Domestic Left-overs	70	56.00
	Scavenging	88	70.40
Place to Provide Feeds	Feeding Trough	125	100.00
Form of Feeding	Dry	1	0.80
	Wet	124	99.20
Provision of Water	Ad libitum	123	98.40
	Once a day	2	1.60
Place to Provide Water	Improvised water trough	125	100.00

The most adapted system of raising native pigs in San Mariano, Isabela was tethering with 70.40 percent (88), followed by complete confinement; 24.80 percent (31); semi-confinement; 2.40 percent (3), range

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without shelter; 1.60 percent (2), and with shelter of 0.80 percent (1). In this setting based on the observations during the survey, families keep an average head of 1 to 2 native pigs, usually being tethered and allowed to scavenge on their own with very limited supplementary feeding. As cited by the Food and Fertilizer Technology Center for Asian and Pacific Region (2017) and Santiago *et al.* (2016), native pig animals can adapt to the environment under any conditions and are currently valued for their heat tolerance, disease resistance, and meat quality. Geromo (2020) reported that the system of rearing native pigs in Luzon practiced complete confinement and tethering which are tied up under the tree while in Visayas and Mindanao, both complete and semi-confinement systems are practiced. In terms of materials used in housing such as walls, roofing, and fencing most raisers prefer to use natural materials. These are locally available resources found in their environment like bamboo, branches of trees, and coco lumber as walling, nipa or cogon grass, talahib, coconut leaves and footstool palm (anahaw) as roofing and some use galvanized iron sheets. Ipil-ipil timber, coconut timber, and bamboo are the most used fencing materials while some use iron steel. Soil as flooring with an average of 72.00 percent (90) is the most common flooring system of raisers while others use concrete floors of about 28.00 percent (35). According to the study by Mesia (2018), native pig housing at Pangasinan was made out of GI sheets on roofing with concrete flooring, and walls are made out of bamboo.

Native pigs at San Mariano were mostly tethered and feeds were primarily dependent on resources available in the locality. As to place to provide feeds and forms of feeding, wet and *ad libitum* feeding is commonly practiced in San Mariano, Isabela where farmers feed their native pigs twice (13.40%) or thrice in a day (89.60%) with the feeds placed in feeding troughs (100.00%).

As to the type of feed given, farm by-products with 97.60 percent (122) such as corn grits, corn bran, and rice bran (darak), and commercially formulated feeds of about 95.20 percent (119) and mixed with water before being given to the native pigs were some systems of feeding in the locality. According to Peñalba (1993), native pigs are good grazers although feeding slops is also commonly practiced. The most common feedstuffs used for feeding native pigs were rice bran, corn, corn, sweet potato tubers, vines, kangkong, and other farm by-products. On the other hand, Falculan (2021) reported that locally available feeds are less expensive but can be nutritionally complete when properly prepared before feeding to native pigs. Native pig raisers in Romblon province practiced mixing commercial and local feeds for feeding due to the high prices of commercial feeds.

Mesia *et al.*, (2018), revealed that the most common feeding management practiced by two Barangays in Western Pangasinan is wet feeding where rice bran is mixed with water. For additional feedstuff, farmers provided kangkong and Ipil-ipil (*Leucaena*) twice a day.

In Isabela Province, the most common practice of feeding was wet feeding of about 99.20 percent (124), some offer dry feeding with 0.80 percent (1) and were given thrice a day. Most common feedstuff given to native pigs were self-mixed (mixture of commercial feeds and farm products) and farm products such as corn, cassava, "darak", and others that are locally available in the community (Cauilan, 2023).

Farm products (79.20%) such as root crops like taro, cassava, sweet potatoes, yams, vegetables, bananas, legumes (*Leucaena*), and domestic left-overs (56.00%) vegetable trimmings, rice wash with fish sauce, and spoiled cooked rice were fed to native pigs and placed in feeding troughs. Clean and fresh drinking water is given daily using an improvised water trough such as tires and containers.

Challenges Encountered in Native Pig Raising at San Mariano, Isabela.

Presented in Table 6 are the challenges encountered in native pig raising at San Mariano, Isabela.

Lack of veterinary services accounting for 99.20 percent (124) was among the challenges encountered by native pig raisers in the municipality of San Mariano, Isabela, followed by the escalating cost of feeds; 85.60 percent (107), housing issues; 48 percent (60), price fluctuation; 37.60 percent (47), feed availability; 29.60 percent (37), marketing of animals; 24.80 percent (31), diseases; 20.80 percent (26), and least challenges encountered was found on cost of medicine with 2.40 percent (3). These challenges must be communicated to the office of the Municipal Agriculturist so that necessary interventions can be done to address these limitations.

Although native pigs can survive through scavenging it requires a balanced diet ration to meet its daily nutrient requirement for a better performance. Since the costs of commercial feeds are high, raisers tend to shift their feedstuffs to farm by-products and farm products that are common and locally available in the locality of San Mariano, Isabela. These findings coincided with Geromo (1993) who stated that most native pig raisers are generally poor, and their means of livelihood is crop-based farming with livestock integration as a secondary source of income. The earned money by native pig raisers was used for their basic needs such as food, clothing, and allowances for their children.

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Housing issues are also among the concerns of raisers since most of the materials used in housing constructions are locally available materials with a soil flooring system. Native pig raisers at San Mariano, Isabela believe that providing ambient and conducive housing for native pigs can be an advantage in production. As to price fluctuation, it greatly influenced the income of native pig raisers at San Mariano, Isabela. Native pigs' meat in our country has a high demand in the market and it is popular for roasting products (*lechon*). There is a steady increase in this product demand as its meat is healthier than exotic breeds' meat based on its crude protein and ash content and lower calorie levels from fat and cholesterol (Dela Cruz, 2016) and when slaughtered at the right weight (20 to 25 kg), the said product is flavorsome and its carcass recovery is comparable to commercial or exotic breeds (Abanto *et al.,*2012; Bondoc *et al.,* 2017).

Table 6. Challenges Encountered in Native Pig Raising at San Mariano, Isabela

Parameters	Frequency	Percentage (%)
Other Inputs		
Lack of veterinary services	124	99.20
Feed cost	107	85.60
Housing issues	60	48.00
Price fluctuation	47	37.60
Feed availability	37	29.60
Marketing of animals	31	24.80
Disease/ Susceptibility to disease	26	20.80
Lack of medicines	21	16.80
Cost of Medicines	3	2.40
Traits Related		
Smaller than exotic breeds	109	87.20
Piglet mortality	85	68.00
Low litter size	39	31.20
None	15	12.00
High litter size	5	4.00
Slow growth rate	3	2.40

But ironically, the value of native pigs in the locality is lower compared to exotic breeds. With these findings, information gathered from the interviews with native pig raisers is consistent with the contention of Moyo and Swanepoel (2010) who stressed the important functions of livestock species in the household. For rural households, livestock plays a very important economic role in improving the income and well-being of the family. Moreover, native pig farming has considerable economic and cultural significance to many rural communities (Silva *et al.*, 2016).

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Several native pig raisers in the locality encountered problems in terms of feed availability. Few of the respondents also encountered challenges in terms of marketing of animals, disease and susceptibility to disease, lack of medicines, and cost of medicines. According to Peñalba and Maddul (1998), the health care of native pigs in Cordillera is very minimal. Treatment for sick pigs using either veterinary drugs and/or traditional herbal medicine is seldom practiced. Additionally, native pig raisers in the study hold on to their traditional knowledge of how to raise and manage their pigs. This could be attributed to the farmers' initial knowledge of pig rearing from parents, relatives, and friends only. As to traits-related issues, the low productivity of native pigs was due to inbreeding and a shortage of feed supply. Most of the farmers practice a high degree of inbreeding since they obtain their breeding stocks and source within the locality or their herd. These may lead to the following results in native pig farming: Smaller than exotic breeds (87.20%), Piglet mortality (68%), and low litter size (31.20%), while few respondents claim that they had not encountered problems as to traits related concerns in native pig raising. High litter size was observed by farmers on breeds which has droopy ears with longer bodies as reported by Layos *et al.,* (2022b) and Oh *et al.,* (2014) which can be due to mutation that distinguishes the Philippine Native Pig distinct bloodline from Duroc, Yorkshire and Berkshire. High piglet mortality (68.00%) may be accounted for due to climate change conditions based on the raisers, high mortality was observed during cold weather conditions due to scouring and other infections.

Conclusion and Recommendations

Based on the results of the study, there are many native pig raisers in the municipality of San Mariano, Isabela. Mature native pigs were generally black with plain color, had straight snouts, and head profile with semi-lop ears. Sexual dimorphism was observed wherein females were heavier and longer than males. Most of the farmers rear their pigs in the traditional system of raising and use readily available farm by-products as feeds. Native pig raising in the locality is limited by lack of access to veterinary services and others. Traits related to native pigs were due to inbreeding since native pig raisers obtained their stocks within the locality.

It is recommended that the breeding and selection of desirable traits must be improved the noted baseline phenotypic characteristics of the existing native pig herd in the municipality and appropriate support to farmers has to be considered to make the native pig enterprise in the municipality profitable.

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