Characterizing smallhold goat production system: Assessment of goat farmers management and production practices towards goat dairying in Central Luzon, Philippines

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Abstract In the Philippines, raisers' management practices were different especially in terms of how the goats were fed. Findings revealed that smallholder goat farmers still practice traditional goat farming system that is characterized by low-cost production input, unmanaged breeding practices and poor feeding program. Majority of the raisers practiced partial confinement while a few reported free grazing, tethering and pure confinement. The absence of a sound goat health program increases vulnerability of goats to diseases. There was low performance in smallholder goat farms. Natural breeding was uncontrolled, hence there was low conception rate (68.11+2.87%). Age of buck at first breeding was highly related with conception rate (p<0.05). Mean kid size was 2.01+0.60 while kidding interval was 210+1.01 days. Meanwhile, mean weight of goats at 3 and 6 months were 7.72+0.07 and 15.49+0.90 kg, respectively. Dairy goat dispersal programs for smallholder goat farmers revealed to face a grim future if preliminary assessment and evaluation on their current management and production practices will not be made as goat dairying needed more intensive management than slaughter goat production. This information can be used in providing appropriate science-based technological interventions for extension programs toward dairy goat production.

Keywords: Smallhold goat farms, Farm characteristics, Goat productivity

Introduction

Goats are versatile animals and is popular among rural folks because it requires minimal investment but provides good return to expenses and family labor (Orden *et al.,* 2013). In this context, goat raising becomes a boon to poverty alleviation. Its contribution may vary but its significance can be

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reflected in revenue generation, cash security, and enhanced qualitative human nutrition (Kumar *et al.,* 2010).

The Philippine small ruminant industry has long been predominated by smallhold goat farms (SGF) accounting for more than 98% of the total goat inventory (PSA, 2019). Raising goats have widely been promoted in the country ever since the government and the private sector appreciated goats as a prime livestock asset. Over the years, the economic endeavour of goats intensifies as various scientific-based technological options in goat production have been developed and effectually improve goat productivity and efficiency. Relatively, the financial viability of slaughter goat production in the rural farming communities are now well recognized (Alcedo *et al.,* 2015; Orden *et al.,* 2016; Intong, 2018a).

To date, the small ruminant industry has been gearing towards dairy goat production. Conforming to this situation, dairy goat dispersal programs have been one of the key priorities of the national government to promote and encourage the key players of the goat industry to venture in goat dairying. Hence, a program was implemented to established community-based dairy goat farms in Central Luzon. However, as goat dairying needs more intensive management than slaughter goat production, characterization on the current management practices and production performance of goats raised under the SGF is needed. This information will serve as point of reference for project implementers in providing appropriate technological interventions and needed extension programs of smallholder goat farmers towards goat dairying.

Materials and methods

Study area and respondents

Central Luzon is one of the most important goat producing regions in the country. The region contributed 8.6% to the country's total goat population of 3,724,808, and ranks 4th in terms of volume of production (PSA, 2019). Four out of seven provinces of the region, namely; Nueva Ecija, Tarlac, Bataan, and Pampanga were the project sites because they are the leading producing areas. Generally, goat production in the study sites was under small hold level. The target population of the research were smallholder goat farmers with existing animal holdings of at least three does but should not have more than 10 head of matured goats and with no more than 22 heads of young. The list of smallholder goat farmers was accessed through the Provincial Veterinary Office (PVO) and Local Government Units (LGU's) of Central Luzon. Prior to the start of the project, meetings were conducted with the LGU's Municipal

Agriculturists and livestock technicians to discuss project implementation and selection of survey respondents. Moreover, specific villages were identified and strategy for data collection was discussed. Using purposive non-probability sampling method, a total of 169 smallholder goat farmers were identified as respondent.

Data gathering

The study follows a structured form of data collection method through conduct of formal survey. A formal survey questionnaire was structured, pre-tested and finalized. Face to face interview was done by trained enumerators to collect quantitative and qualitative data to characterize small hold goat production system in Central Luzon. It was divided into five main parts to include the following: farmers' socio-demographic characteristics, farm characteristics, husbandry practices, and production performance. The questions were asked in a predefined order and were administered using English and local language for clarity of communication to the respondents. The survey was conducted between January to March, 2019.

Data analysis

The data were encoded using MS Excel (2010) and were analysed using Statistical Package for Social Sciences (SPSS). In describing the qualitative data, descriptive analysis such as frequency distribution was used while measures of central tendency and variability were used for quantitative data. Pearson's correlation coefficient was used to determine the relationship between farm performance and management practices, with ($p<.05$) to determine significance of the relationship.
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Results

Socio-demographic characteristics of smallholder goat farmers

Descriptive analysis shows that males (70%) were the predominant holders of the SGF. About 82% of the respondents were married and classified under the middle aged between 31-60 years old. Although majority of them were married, the husband was more actively involved in rearing goats than their wives and children. The literacy level among the smallholder goat farmers in the region was 100%. About 57% have finished their basic education program while 44% have received their college degree.

Relatively, about 47% of the respondents rely directly on agriculture as their primary source of income. Although all of the respondents were raising goats, 53% of them were also engaged in other professions. The recorded mean annual gross household income of smallholder goat farmers during the survey period was PhP 382,766.90. Meanwhile, in terms of income in goat raising, farmers reported a mean annual income from goat of not more than PhP 20,000.00. Goats are being marketed on a live per head basis and mostly sold for meat production. Slaughter goats are sold at prices ranging from PhP 3,000-5,000.00 while breeder goats were sold at PhP 4,500-9,000.00 (Table 1).

The mean landholding of smallholder goat farmers recorded in this study was 3.41 hectare, of which a large proportion was allotted for production of rice and vegetable crop. This is not surprising since Region 3 is recognized as the rice granary and onion capital of the country. Although, about one hectare were allotted for animal production only few farmers have utilized the area to establish improve pasture.

Smallholder goat farmers in Central Luzon had fairly long experience in goat raising for about 19 years. As source of income (70%) is the primary reason cited for keeping these livestock animals. Also, twelve (12) out of the 169 respondents have mentioned that the characteristics of goats which requires simple management and low-cost production inputs opted them to venture into goat raising. Subsequently, a small proportion of the respondents (5%) have mentioned of raising goats for meat consumption. Remarkably, the low content of saturated fatty acids and cholesterol of goat meat makes it a healthier alternative to other red meat.

Table 1. Socio-demographic characteristics of smallholder goat farmers in Central Luzon

Variables	Frequency n=169	Percentage (%)
Gender		
Male	119	70
Female	50	30
Age		
Below 15 years	0	0
15-30 years	15	9
31-60 years	125	74
Over 60 years	29	17
Marital Status		
Single	22	13
Married	138	82
Widowed	9	5

Table 1.(Con.)

Variables	Frequency n=169	Percentage (%)
Elementary graduate	29	17
High School graduate	67	40
College level	17	10
Vocational course	12	7
College graduate	43	25
Post graduate	1	1
Employment		
Farmer	80	47
Government Employee	34	20
Self-Employed	40	24
Unemployed	15	9
Annual gross household income (PhP)		
Mean	*382,766.90*	
Annual income from goat raising (PhP)		
Mean	*19,200.00*	
Land holding (ha)		
Mean	*3.4*	
Length of years engaged in goat raising		
Mean	*19.0*	
Reason for engaging in goat production		
Source of income	119	70
Good source of meat	9	5
Hobby	5	3
Easy to manage	12	7
Utilization land	3	2
Caring for others	3	2
Easy to market	1	1
Other reasons	17	10

Farm characteristics

The present study revealed that 53% of the smallholder goat farmers had sourced out their stocks from nearby goat farms in their locality. Interestingly, about 23% served as contract growers with an informal consensus that for every kidding, half of the offspring's produced will be their ownership. Meanwhile, 7% of the respondents have mentioned of receiving goats from various government livestock program (Table 2). However, none of them have received dairy goat breeds. In terms of selecting breeder stocks, a high proportion of the smallholder goat farmers focused on body size of the animal. Apart from this, goat breed (23%) and size of testicles (21%) was highly favored when selecting breeder bucks. Common to all the respondents is to select purebred or upgraded

bucks with high bloodline to improve the performance of their flock. Alternatively, udder characteristics (28%) is one of the most criteria cited when selecting breeder does.

Table 2. Source of stocks and criteria for selecting breeder goats

Parameter	Frequency (n=169)	Percentage (%)
Source of Stocks		
Born	23	14
Bought	90	53
Caring for others	38	23
Loan	5	3
Government Program	12	7
Criteria for choosing breeder buck, % farm reporting		
Body size	102	60
Breed	39	23
Coat	25	15
Feet and legs	20	12
Horns	15	9
Testicles	35	21
Others	18	11
Criteria for choosing breeder doe, % farm reporting		
Body size	88	52
Breed	21	12
Coat	18	11
Feet and legs	16	9
Horns	13	8
Udder	48	28
Others	40	24

About 55% of the SGF were under partial confinement production system while 30, 12 and 3% were under free grazing, tethering and pure confinement operation (Table 3). The duration of grazing of goats under partial confinement is variable while goats under the free-grazing system browse on pastures for unlimited period during daytime. Grazing of goats on communal pasture area is a common practice in most of the farms.

Central Luzon is characterized under Type I climate with two pronounced seasons: dry from November to April and wet during the rest of the year (DOST-PAGASA, 2015). Relative to this, most of the goat house are elevated shed type structures constructed using wood (45%) and bamboo (38%). The recorded size of goat house in this study ranges from 11-50 m^2, just enough to house the recorded mean animal holding of 14 heads.

Table 3. Type of production and housing designs

Parameter	Frequency	Percentage (%)
Production System		
Tethering	20	12
Free-grazing	51	30
Partial confinement	93	55
Pure confinement	5	3
Size of Housing (m^2)		
1-10	43	26
11-50	64	38
51-100	20	12
101-500	26	16
501-1000	6	4
1001 and above	9	6
Floor Type		
Elevated	103	61
Slatted	22	13
Wood	21	13
Concrete	4	2
Plastic Matting	5	3
Others	13	7
Materials Used		
Wood	76	45
Bamboo	64	38
Steel	14	9
Indigenous Material	6	4
Others	8	5
Roofing Material		
Cogon	20	12
GI Sheet	131	77
Others	18	11

Feed resources for goats

Characterized by partial and free grazing production system, native pastures (73%) were the most common feed resources offered to goats. Although a high proportion of the respondents (51%), have mentioned of feeding goats with legumes such as *Leucaena leucocephala*, *Gliricidia sepium* and *Desmodium cinerea,* it was given irregularly. On the other hand, only 25% of the respondents feed their goats with improved grasses (*Panicum maximum, Bracharia mutica,* and *Pennisetum purpureum*). On the average, smallholder goat farmer report daily feeding of goats of about 3-4 kg of grasses and 0.2-0.5 kg of legumes. Apart from forages, crop residues such as rice straw, corn stalk, banana peel, mungbean and soybean pod were also utilized as feed for goats.

Out of the 169 respondents, only 15% practice feeding of concentrate feeds. Nevertheless, feed supplements such mineral block, salt and molasses were being offered to goats specially during dry period where a diminishing supply of forages is pronounced (Table 4).

Table 4. Feed Resources for goats, % farm reporting

Types of Feeds	Frequency n=169	Percentage (%)
Native grass	123	73
Improved grass	43	25
Legume	87	51
Tree leaves non-legume	34	20
Crop by-products	6	4
Concentrates	25	15
Agro-industrial by-products	20	12
Supplements	38	22
Silage	3	2

Breeding management and practices

The present study shows that upgrading (31%), crossbreeding (43%) and pure breeding (25%) were the predominant breeding scheme practiced in SGF (Table 5). Characterized by partial and free-grazing production system, uncontrolled breeding is the predominant mating system being practiced while natural breeding (96%) still stood as the most preferred breeding method over artificial insemination (4%). Nevertheless, 85% of the respondent shows willingness to adapt artificial insemination in the farm whenever it is available.

Table 5. Breeding practices, % farm reporting

Parameter	Frequency n=169	Percentage (%)
Breeding Scheme		
Cross breeding	73	43
Pure breeding	43	25
Upgrading	53	31
Mode of Breeding		
Natural	163	96
Artificial Insemination	6	4
Willing to try AI		
Yes	143	85
No	26	15

Goat husbandry practices and health related problems

Goats just like any other livestock animals has its own management practices for normal growth and development. Regardless of the type of production system, bottle feeding of kids (62%) registered as the most common husbandry practices performed in goat farms. Alternatively, about 60% of the respondents are not practicing husbandry activities such as hoof trimming, bathing/dipping, castration of goats among others. Although all of the respondents have mentioned of cleaning the house daily, only few practices farm disinfection (19%). Nevertheless, record keeping was being practiced in farms under pure-confinement production system.

Table 6. Goat husbandry practices, % farm reporting

Husbandry Practices	Frequency n=169	Practicing Husbandry Practices (%)
Bottle Feeding	105	62
Hoof trimming	19	11
Animal Identification	45	27
Bathing/Dipping	44	26
House/Pen Disinfection	32	19
Castration	66	39
Record Keeping	65	38

In terms of goat health-related problems, cases on diarrhea (123), pneumonia (42) and cough (36) were identified as the most prevalent disease reported (Table 7). The high prevalence of diarrhea could be attributed to the presence of internal parasites (21) and grazing of goats in communal pasture areas. In case of pneumonia and respiratory related problems, grazing of animals even during rainy season and improper goat housing designs were among the aspects that could associate to the prevalence of this disease. Remarkably, common to all farms is the prevalence of diarrhea and pneumonia during rainy season. Furthermore, cases of hypoglycemia (12) and lameness/paralysis (24) in goats were also reported during the survey. According to the respondents, weakening of kids were mostly observed when the dams die or have no milk supply. On the other hand, SGF practicing pure confinement production system frequently experienced cases of lameness/paralysis of goats. Cases of animal bites (dog and snake) were also reported in farms under partial and free-grazing production system.

Table 7. Occurrence of disease in smallhold goat farms

Diseases	No. of cases	Prevalence (%)
Diarrhea	123	73
Anemia	1	1
Pneumonia	42	25
Hypoglycemia	20	12
Bloat	28	17
Hardware disease	4	2
Lameness/Paralysis	24	14
Internal Parasite	21	12
External Parasite	5	3
Orf	29	17
Heat Stress	3	2
Dystocia	4	2
Bites	17	10
Cough and cold	5	3
Cough	36	21
Cold	5	3
Others	36	21

Goat inventory

The total inventory of goats recorded in this study was 2,247 heads (Figure 1). On the average, each farm has a recorded animal holding of 14 heads. Native, upgrades and crossbreeds were the most predominant breed raised in all farms. Native breed of goats covers the 60% of the total inventory. About 59 goats were purebred or exotic breed which are primarily use as breeder bucks to infuse into the native and upgraded stocks. The characteristics of Boer of having high growth rate and average daily gain, favors the farmers goal to produce heavier stocks at marketable age. In the same manner, upgrading using Anglo-Nubian increases milk yield of dams to support the sustenance of the young. However, although several exotic breeds are now present in the country, the hardiness and high resistance to disease of native goats still fits to the traditional way of farming in rural communities.
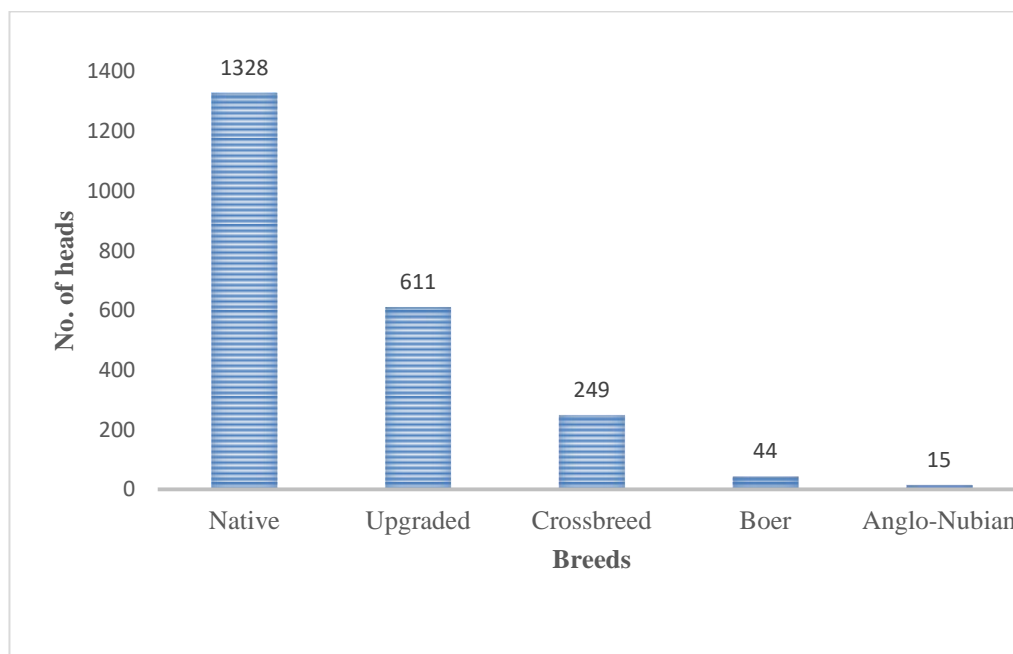
Figure 1. Goat inventory in smallhold goat farms

Growth and reproductive performance of goats

The goat's growth performance was measured in terms of birth weight, weight at 3 and 6 months (Table 8). The mean birth weight of goat was recorded at 1.12±0.07 kg, while weight of goats for 3 and 6 months were recorded at 7.72±0.62 and 15.49±0.90 kg, respectively. Based on this data, average daily gain (ADG) of goats was computed at 78.69±5.11 and 73.28±6.94 kg for 3- and 6-month period.

In terms of goat reproductive performance, results shows that the mean age at first breeding of does and buck is 6.72±0.29 and 6.29±0.38 months. For every one male breeder buck, the equivalent number of breeder doe is six. Despite the use of natural breeding, conception rate (CR) of does across region is relatively low with 68.11±2.87%. Furthermore, the mean kidding interval of does stand at 210±1.01 days while mean kid size was recorded at 2.01±0.60 head.

Relative to the above results, the correlation analysis between reproductive performance and practices shows a significant relationship between age at first breeding of buck and CR, (r=0.360) ($p<0.05$). Contrarily, a weak but no significant relationship between age at first breeding of does and CR, r= 0.205, $p>0.05$ were observed. A significant relationship was also observed between post-partum breeding (PPB) and CR, r= 0.031, $p<0.05$. On

the other hand, PPB shows no significant relationship with kid size $r= 0.400$, p>0.05. The mean PPB of goats reported is about 60 ± 12.10 days. This data implies that if farmers weaned their goat at 90 days, the subsequent conception of does from the time of kidding happens at about 60 days where the doe is still nursing the young.

Table 8. Growth and reproductive performance of goats

Parameters	Mean $\pm$ SE
Weight, kilogram	
Birth	1.12 ± 0.07
3 months	7.72 ± 0.62
6 months	15.49 ± 0.90
Average daily gain, grams	
90	78.69 ± 5.11
180	73.28 ± 6.94
Age at first breeding, months	
Buck,	6.29 ± 0.38
Doe	6.72 ± 0.29
Buck to Doe Ratio	1:06
Conception Rate, %	$68.11 + 2.87$
Kid size, head	2.01 ± 0.60
Post-partum breeding, days	60 ± 12.10
Kidding interval, days	210 ± 1.01

Table 9. Correlation analysis between reproductive performance and practices

Reproductive Practices	Reproductive Performance			
	Conception Rate		Kid Size	
	coefficient	p-value	coefficient	p value
Age at first breeding of doe (mo.)	0.205	0.181	-	-
Age at first breeding of buck (mo.)	0.360	0.014	-	-
Post-partum breeding (days)	0.400	0.007	0.031	0.842
Age at first kidding (mo.)	-	-	0.109	0.487

Discussion

Several goat farms in Central Luzon have been accredited by the national government for selling goats with good genetics and pedigree record. However, the high cost of genetically superior goats' compromise farmers desire to purchased quality breeder stocks. Moreover, the absence of goat organization

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and limited knowledge of the smallholder goat farmers on goat dispersal programs are all contributory factor why only 12 out of the 169 respondents become beneficiaries of this programs. In terms of selecting breeder stocks, body size, breed, size of testicles and udder characteristics was highly favored by most of the respondents. As reported by Agga *et al.* (2011), body size and testicular measurements have been found to be important parameters for evaluating breeding soundness. Previous study of Bitto and Agam (2012) also reported that heavier and larger testicle produce more spermatozoa which implicates breeding a larger number of does. Meanwhile, udder morphology is positively correlated with the goat's milk yield and milking ability (Capote *et al.,* 2006).

Goats in the Philippines are sustained on unimproved management system, mostly through tethering and extensive grazing (Intong, 2018a). Surprisingly in this study, more than half of the SGF were under the partial confinement production system. Goats under this system are being grazed for 4 to 6 hours during daytime and stallfed with variety of forages. This management is however different compared to pure confinement production system where farmers practice cut and carry feeding system. On the other hand, despite of the dis-advantages of free- grazing production system (uncontrolled mating, low productivity and absence of recording) it's still convenient for smallholder goat farmers who work full time during daytime and with small number of animal holding.

Depending on the availability of construction materials and financial capacity of the raiser, goat house was built to provide protection for the animals. Relatively, the availability and cheaper price of wood and bamboo favors its use as a construction material across all farms. More so, as claimed by some of the respondents this material improves air quality of the goat house especially during dry months. On the other hand, although several studies have proven the good effect of using plastic matting on goat performance (Kumari *et al.,* 2013; Ramachandran *et al.,* 2020), only three smallholder goat farmers used this type of flooring material as its high market price makes it uneconomical to be used in SGF. Contrarily, dairy goat farms in the country primarily used plastic matting as their flooring material (Manalili *et al.,* 2020).

Goats are highly adapted to a broad range of climatic and geographic condition, however, proper housing, floor space requirements and ventilation are among the factors affecting goat feeding behavior, immune and endocrine response (Loretz *et al.,* 2004; Sevi *et al.,* 2009; Lamesegn, 2018). During the survey, it was notable that although goat housing was provided, it was not actually designed to give comfort and optimum protection for the animals. Some of the goat house has no partitions or division to even separate male from

female goats nor healthy from sick animals. Hence, it could be argued that smallholder goat farmers were not actually aware on the consequences of providing improper housing facility in terms of goat health and productivity.

Common to all farms is grazing of goats on communal pasture where they have free access to bushes, shrubs and tree leaves. Native pastures were the most common feed resources offered to goats. However, a diminishing supply of these roughages were reported during dry months. Conferring to the study of Intong (2018a) during this period goats normally suffer from nutritional deficiency. Although a high proportion of the respondents feed their goats with legumes, it was given irregularly. Accordingly, due to its high crude protein content and economic advantages in goat feeding, several researches have been conducted to characterize the production performance, nutrient content as well as the anthelmintic properties of different legumes in the country (Orden *et al.,* 2017; Manalili *et al.,* 2018).

Forages should have at least 12-16% CP to satisfy the goats nutritional needs. On the average, smallholder goat farmers report daily feeding of goats of about 3-4 kg of grasses and 0.2-0.5 kg of legumes. Among the grasses, *Panicum maximum, Bracharia mutica,* and *Pennisetum purpureum* were mostly offered in goats under the cut and carry feeding system. On the other hand, adopting concentrate feeding seems to be impossible for most of the smallholder goat farmer due to its high market value. This is in contrast to the practice of dairy goat farmers in the country of feeding goats with 0.5 to 1.0 kg of concentrate on a daily basis (Manalili *et al.,* 2020). According to Balehegn *et al.* (2020) in period of feed shortage, supplementing concentrate is essential to cover the nutritional requirements needed by the animals. Generally, the smallholder goat farmers were not actually aware of whether or not their goats satisfied its daily nutritional needs.

Agricultural crop residues and agro-industrial by products were among the feed resources that could serve as a potential feedstuff during dry months. Consequently, during this period feed supplements such as mineral block, salt and molasses were being offered in most of the SGF. Accordingly, studies of Osman *et al.* (2020) and Farrag *et al.* (2021) have proven that at a given concentration, molasses can improve the milk and meat characteristic of goats while supplementation of trace minerals ensured better goat reproductive performance.

Uncontrolled breeding is the predominant mating system being practiced in the SGF. Regardless of relatedness and preparedness of bucks and does in terms of age and weight, the goats were allowed to breed indiscriminately. Although farmers were aware on the negative effect of uncontrolled mating, this system is easier and convenient for farmers having small goat holdings. On

the other hand, the presence of breeder buck in SGF brought credibility to the use of natural breeding. Consequently, upgrading and crossbreeding where the predominant breeding scheme practiced in SGF. Neither by chance or objectively, crossbreeding of goats usually happens in communal grazing areas where goats are graze together regardless of their age, sex and breed. Meanwhile, with the aim of producing bigger and heavier offspring, the Boer and Anglo-Nubian breed were widely used in farms practicing upgrading as their breeding scheme. According to Bondoc (2005) as cited by Alcedo *et al.* (2015), the use of imported exotic breeds is a convenient and popular approach to combine the superior production potentials of the imported stock with the hardiness and adaptability of the native goats to the local environment.

Regardless of the type of production system, cases in diarrhea and pneumonia were categorized as the most prevalent disease reported in this study. The high prevalence of diarrhea could be attributed to the presence of internal parasites and absence of deworming program across all farms. As mentioned by the respondents, deworming of goats is only being practice when there is already occurrence of this disease. This result agrees to the findings of Rupa & Portugaliza (2016) wherein the absence of a sound helminth control measure resulted to the high prevalence of gastrointestinal nematodes which causes the diarrhea of goats in Visayas. Meanwhile, grazing of goats even during rainy season, crowded pen/house and absence of any disease control measures were among the factors associated to the prevalence of pneumonia and respiratory related problems in this study. According to Underwood *et al.* (2015) crowded housing may cause ammonia build-up and other waste gases that may induce respiratory problems. Although vitamins and mineral supplementation were being practice, it was given irregularly. Furthermore, cases of goat lameness/paralysis were reported on SGF practicing pure-confinement production system. The same case was also reported in other studies in the country (Cosadio *et al.,* 2011; Alcedo *et al.,* 2015; Manalili *et al.*, 2020). Relatively, Matthews (2016) cited that poor foot care is a common cause of lameness in goat. Conferring to this statement, not practicing hoof trimming could be one of the reasons for the occurrence of lameness/paralysis in this study. Accordingly, as stated by Alcedo *et al.* (2015) the level of goat's exposure to diseases and injuries depends on the farmer's health and husbandry competence.

The mean birth weight of goat recorded in this study (1.12$\pm$0.07 kg) is lower compared to the reported backyard goat farm performance across the country of 2.03 kg (Barcelo *et al.,* 2016). Likewise, a difference of about 2.6 kg in the weaning weight of goats were computed when compared to the result of the same study with about 10.32 kg. The low birth weight of goats recorded in

this study could be attributed to the early breeding of does as this practice causes stunted growth and production of weak and lighter kids (PCAARRD, 2004). Furthermore, it should also be noted that Native goats dominates the total number of goats in this study. Hence, conferring to the study of Bourdan *et al.* (1997), there is a high possibility that the low growth rate of Native goats was inherited by the offspring produced as growth performance is classified under moderate and high heritability traits.

On the other hand, although sexual maturity of Native and Upgraded goats can be observed as early as 5 months and 7 months, the preparedness of goats in terms of age, body weight and health condition should be considered prior to breeding. The buck to doe ratio (1:6) in this study is relatively low compared to the recommend standard of 1:25 (PCAARRD, 2004). Moreover, despite the use of natural breeding and low buck load, the recorded CR is relatively low with only 68%. Aside from the credibility of breeder bucks, the continuous breeding practice and early breeding of goats are attributable factors to these results. The reported kidding interval of dams is also shorter compared to the report of Barcelo *et al.* (2016) with 251 days. Meanwhile, the mean kid size of goats reported is higher than the recorded data of Barcelo *et al.* (2016) and Intong *et al.* (2018b) of 1.6 and 1.44 head. The characteristic of Native goats of being prolific could be one of the factors for the high kid size reported in this study.

Several factors contribute to variation in CR, this includes season, nutrition, age, and breed. The practice of early breeding across all farms and the high number of Native does which comprise the 75% of goats in this study contribute to the result of having a weak but no significant relationship between age at first breeding of does and CR, $r= 0.205$, $p>0.05$. On the contrary, a significant ($p<0.05$) relationship between age at first breeding of buck and CR were recorded. According to Kridli and Said (1999) and Price *et al.* (1991) matured bucks had higher ejaculation efficiency than younger goats, hence, the higher the chance that it can impregnate does. A significant relationship was also observed between PPB and CR, *($r= 0.031$, $p<0.05$)*. Apparently, goats' PPB is computed at about 60 days. Hence, with a weaning period of 90 days, it could be inferred that subsequent conception of does from the time of kidding happens when the doe is still nursing the young. During this period the doe lost the chance to undergo body conditioning which is a critical part for breeding preparation. A fact which possibly explains how PPB affects CR of goats in this study.

In conclusion, dairy goat dispersal programs intended for SGF seems to be faced a grim future if the key players of the industry will not be assessed and guide properly. This study provides a comprehensive understanding on the

current management and production practices employed among SGF in Central Luzon who are the potential beneficiaries of this programs. Results showed that smallholder goat farmers in the region still practice traditional goat farming system characterized by low-cost production input, mismanaged breeding practices and unimproved feeding program. The absence of a sound goat health program across all farms also increases vulnerability of goats to dieseases. This in turn opposed the productivity and profitability of goats under the smallhold goat farms. These are all prolonged been problem of the goat industry that has already been addressed through development of various science-based technologies in goat production. Hence, much is still needed in bringing these useful and proven technologies down to the farmers level. It is therefore recommended that this study serve as point of reference for project implementers, as well as the mandated local and private sector implementing dairy goat dispersal programs in providing appropriate science-based technological interventions and needed extension programs towards dairy goat production. Special attention should be paid in capacitating these smallholder goat farmers for them to be able to understand that improvement in management practices is inevitable to create more opportunities that they can invest on goat production.

Acknowledgements

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