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Original Article

Breeding strategy and contract farming model to promote Boer Cross population continuity: A case study at Sadhana Arif Nusa Company Lombok Island West Nusa Tenggara Province, Indonesia

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Abstract

Objective: This study aims to implement recent contract farming models in East Lombok Regency West Nusa Tenggara Province, in order to increase farmer income and ensure Boer cross goat population continually increase.
Methods: The study employed by survey methods. Precious contract farming model and Boer cross-goats data were obtained from the log book of SAN-C. Supporting data obtained from in-depth interviews and FGDs with representatives of farmers, livestock traders, representatives of the East Lombok district government, and management representatives of SAN-C.
Results: This study found that the recent contract farming model give the same opportunity to get the same profit for both SAN-C and farmers. A profit-sharing system based on the weight of the goat due to the difference in the final weight minus the initial weight multiplied by the price per kilogram divided by two, one part for SAN-C the other part for farmers. Thus, the cash earned by farmers is close to the minimum standard wage for the district of East Lombok.
Conclusions: Recent contract farming models ensure that San-C and farmers earn equal profit and ensure Boer cross goat population sustainably increase. It is recommended that the recent contract farming model can be applied to the other farmers in all over WNT. It was also recommended that both SAN-C and must make a selection, especially for F2 and F3 with the most superior phenotypes as stock breeders. Finally, excess feed production in the rainy season should be stored in the form of hay or silage to overcome shortage of feed in the dry season.

Keywords: Contract farming; Farmers; Income; Productivity; Sustainability

INTRODUCTION

The province of West Nusa Tenggara (WNT), Indonesia, consists of two islands: the Lombok and Sumbawa islands. The area is 20,164.84 km^2. The total population is 5,389,998, consisting of 2,695,522 men and 2,694, 446 women. The density is 255 people/km^2 [1]. In the province, goats are an important part of the income structure of farmers. The most dominant type of goat is kacang goat. In 2021 the goat population was recorded at 711,459 heads [1].

In general, the main obstacle for goat farmers is the lack of capital. Therefore,

contract farming is one solution. An example of goat contract farming is an investor giving goat to farmers. Both investor and farmers agree to share the goat kids produced within the certain time, but the farmer does not receive any share from the nanny [2]. There are three models of the process of selling goat kids as described by Sahoo *et al.* [2]. First, the sale of kid goats is the business of each without any help from investor. Second, the sale of kid goat is carried out by each but the investors help farmers to find buyers. Third, the process of selling the kid goats carried out by investor and farmers get their share according to the agreement.

Kacang goat is a native Indonesian goat that has a small body weight compared to other goat breeds. However, kacang goat has high adaptability to the local environment, reproductive capacity and diseases resistance [3]. Kacang goat has a relatively small body size, a light and small head, short ears pointing straight up, high adaptability to unfavourable natural conditions and very high reproductive performance. It is also a relatively low rate of daily weight gain [4]. Body weight of female Kacang goats at maturity is around 19.14 kg to 24.31±4.53 kg [4, 5]. Crossing the Kacang goat with the Boer goat, the best meat goat in the world, is one method to increase its productivity [6]. The long history of the Boer goat with its various advantages [7,8] has prompted the first full-blood Boers embryos to form Australia to be brought into the WNT in 1999 [9]. Of the 10 frozen embryos transferred (ET) to the Kacang goat, 3 males and 1 female were born [9]. Furthermore, those Boer cross goat kids of ET became the initial capital for breeding Boer cross goats on Lombok and Sumbawa Island, WNT Province.

Today, the popularity of Boer Cross in Lombok Island increased significantly, and many farmers are interested in Boer cross. The impact of the Boer cross goat prospectus research results in the Boer goat has significantly changed the mindset of farmers at least Sadhana Arif Nusa Company (SAN-C) whose primary business is tobacco cultivation, participates in developing it. In the early 2010's SAN-C started to raise 180 Kacang goats and 6 full blood Boer goats imported from Australia. The goats were breed naturally in SAN-C breeding center. The reproduction and production data of Boer Cross is well recorded and becomes a reference for projections and calculations of the feasibility of the Boer goat business for improving the previous contract farming system.

In addition to developing Boer cross goats, SAN-C collaborates on goat development with farmer groups to provide employment and earn a decent income. All farmers are landless. In fact, the previous contract farming model that was carried out was not successful, as evidenced by the relatively low rate of return from farmers. Therefore, this follow-up study aims to develop a Boer cross-goat breeding strategy and improve the model of contract farming with partner farmers, its implementation and success rate. In the end, the Boer cross-breeding and recent contract farming models will become a reference for similar programs that are mutually beneficial and become substantial income for landless farmers.

MATERIALS AND METHODS

Research sites

This research was focused in the central breeding and development of the Boer goat "Sadhana Arif Nusa Company (SAN-C)" region of West Nusa Tenggara, Indonesia, which is located in Tiu Borok village, East Lombok Regency. The research was carried out from the beginning of 2019 until the end of 2021.

Data collection

This research was conducted with survey method. During the research period, data was collected and discussed and formulated the concept of development was followed by implementation of recent contract farming models.

The collection of data and information was carried out through three methods. First, quantitative data consisting of goat data obtained from the log book data of SAN-C. Second, evaluate the previous contract farming model implemented before the research and during study and after first round of recent contract farming model. Third, in-depth interviews with 10 partner breeders and 5 official team members from

SAN-C. Fourth, Focus Group Discussion (FGD) with 10 partner breeders, 5 official teams from SAN-C, 2 people from the Animal Husbandry Service and 3 goat traders, to obtain in-depth and complete data and information about the subject of the study.

Data analysis

The data was tabulated, the average value was calculated and then interpreted and presented descriptively, compared with the results of previous studies and reinforced by arguments, theoretical foundations and references relevant to the topic of discussion.

RESULT

Previous model contract farming

From the results of the study, it was revealed that the contract farming system was a credit system. In the six years from 2014 to 2018, the number of partners was 86 families and 430 goats or 4 females and 1 male per partner, equivalent to IDR 7,500,000 plus a cage construction cost of IDR 1,000,000 for each partner. Medicines, if needed, are the responsibility of the partners. In 2016, the number of partners increased to 400 families with 1,600 goats. The number of goats varies between 3-5 goats plus the cost of the cage with a loan value of IDR 5,500,000 - 8,500,000. The return on investment of 100% plus an interest of 8% a year is carried out in stages over 2 years.

The return on capital plus 8% interest is made one year after the loan is granted. Loan repayments are made in cash or the form of goats at a price agreed by both SAN-C and farmers. The results of this study found that the rate of return on capital plus interest from all partners from 2014 to the end 0f 2018 was an average of 57.3%, while the rest had no solution until now.

The results of in-depth interviews with previous model partner breeders, some officials of SAN-C identified several factors causing the partners' failure to fulfill their obligations. First, the use of buck in each partner cluster is dominated by the group leader, so the breeding process is less efficient, resulting in low kid births. Second, goat prices deeply fluctuated throughout the year. Third, the feed availability is also fluctuated depending on seasons. The accumulation of these three factors is the high number of unpaid loans and the margin obtained by both partners and SAN-C is not feasible. The recent contract farming model agreed is as follows.

Model of recent goat contract farming

Based on the 2014-2018 contract farming model evaluation results, model changes were made contract farming became 100% profit oriented based on body weight gain during the contract period. The assumption of daily body weight gain is based on the average weight gain recorded by SAN-C as listed in Table 1. SAN-C and partner farmers get the same benefits with this recent contract farming model. There are three models of contract farming schemes that have been agreed upon, namely:

A. Model A (Male fattening)

The first contract farming model is male goat fattening. Profit prediction opportunities for model A are shown in Table 2. This program started in early December 2020. The investment for partners is several young male goats. The initial and final weight of the goat will be weighed. The profit is the difference between the final weight minus the initial weight times the price of live weight per kg divided by two.

B. Model B (Female fattening)

The second contract farming model is female fattening goats. The profit prediction opportunities for model B are shown in Table 3. The profit sharing is calculated in the same way as model A. After the young female goat is returned to SAN-C, then localized in the mating pen, naturally, mate with full-blood Boer goats until they are pregnant. Furthermore, the pregnant female goats are distributed to Model C partner farmers.

C. Model C (Breeding)

The third contract farming model is breeding for 7-8 months per period. Partner breeders will receive females that are 1-2 months pregnant. Pregnancy detection is done using ultrasonography. In the fourth month, it is projected that all females kidding with an average litter size of 1.5 are alive and healthy. Model C partner breeders earn income from the accumulated live weight of kid goats that

Table 1. Data on daily and monthly body weight gain of Boer cross goats

No	Kid goat ID number	June 2019	Sept 2019	Weight gain	
		Body weight (kg)	Body weight (kg)	Daily (gr)	Monthly (Kg)
1	ABO2/8701	19.50	33.42	140	4.20
2	EBO2/8B05	19.10	32.05	135	4.05
3	CA02/8708	15.70	28.35	112	3.35
4	EDO2/8B02	10.80	19.00	67	2.00
5	C001/8B90	17.60	31.90	163	4.90
6	C001/8B09	16.90	28.40	147	4.40
7	C001/8986	15.70	29.50	133	4.00
8	E001/8915	12.35	23.00	133	4.00
9	E9306	17.55	26.05	168	5.05
10	E9260	15.65	30.50	167	5.00
11	E9294	15.36	25.60	120	3.60
12	E9293	15.15	27.95	165	4.95
13	PY378/8505	14.60	25.90	147	4.40
14	C9316	10.90	22.95	148	4.45
15	PY249	10.20	17.40	63	1.90
	Sum	216.50	401.75	2,088	60,25
	Average			143	4,3

are approximately 3 months old multiplied by the price per kg live weight of goats (Table 4). Furthermore, male goats are distributed to model A partner breeders, while female goat kids are to model B partners.

From the three alternative models of contract farming, farmers will get relatively the same income. The more the farmer put himself into taking care of his goat, the higher the weight and the higher the income. So that the opportunity for farmers to get the same income, the application of this model can be done flexibly, namely, one partner farmer can do one of the three models A, B, C, or a combination of all three at once.

Implementation of the commitments of the East Lombok district government

Feed is the most crucial issue for partner goat breeders. Less land ownership is the main reason partner breeders cannot provide maximum productivity and quality feed

Figure 1. Tarramba plantation area and breeding center (top left), partnership pens (top right), stage cages for pregnant nany (bottom left) and various filial male and female weaned Boer-cross for fattening (bottom right)

throughout the year. Therefore, SAN-C has obtained a Hak Guna Usaha (Cultivation Right) from the local government of East Lombok to utilize an area of 400 ha for animal feed, a breeding center and a home base for SAN-C goat management (Figure 1).

Margin projections for the three profit-sharing collaboration models

Margin projections obtained by each partner for each model are prepared based on the failure of the previous collaborative model and daily weight gain data. The projected profit for each partner per month is IDR 1,462,000, 1,250,000 and 1,181,000, respectively, for models A, B, and C, as listed in Tables 2, 3, and 4.

Results of the implementation of the recent contract farming model

The trial of 3 models of the recent contract farming model was carried out from June 2019-2021 (Table 5) and is currently ongoing for 6 partners (Table 7). The results from this study indicate that the three models of goat husbandry development and contract farming have been running according to plan, with the return and interest rates reaching 100 percent. The monthly income of farmers is between IDR. 911,250-2.500.000 or an average of IDR 1,810,126 per month or higher than the projections in Tables 2, 3 and 4. The monthly income of farmers is still slightly below the provincial minimum wage (PMW) however, it is clearly in this direction and over time, the availability of feed and experience of farmers is not impossible shortly the monthly wages of farmers will possibly match and even exceed the Provincial minimum wage.

There are several obstacles encountered during the research that need improvement. The main obstacle is feed production sharply decreased during the dry season. Tarramba, for example, is abundant in the rainy season, while in the dry season it decreases drastically. As a result, goat productivity and farmer wages have also fluctuated. The second obstacle is that the full-blood Boer bucks are getting old and less productive; even 2 of them have died. Third, the recent contract farming model has not been implemented in a revolving manner among partner breeders, so it impacts the income disparity of partners.

DISCUSSION

Feed is the main problem that has always been an obstacle for farmers to maintain livestock productivity throughout the year. A critical environmental factor in the growth of the goat is nutrition. Feed will be available in abundance during the rainy season and decrease significantly during the dry season. Since SAN-C obtained a concession area of 800 ha, of which 116 ha have been planted with Tarramba, some feed needs have been met. However, an applicable method is needed so that excess feed during the rainy season can be stocked in the form of hay to stock up during the dry season.

Tarramba is a type of legume rich in protein which is very good for goats. The nutritional value is quite good when viewed from the nutritional composition, as reported by two researchers. The chemical content of Tarramba leaves (*Leucaena leucocephala* cv. Tarramba) is ash 11%, nitrogen 4.2%, protein 25.9%, crude fiber 20.4%, calcium 2.36%, phosphorus 0.23%, beta carotene 536 mg/kg, gross energy 20.1 KJ/g, and tannin 10.15 mg/g [10]. Other researchers [11] reported that the leaves and young twigs of Tarramba contained 8.8% water, 22.0-36.8% protein, 5.4% fat, 16.1% carbohydrates, 1.3% ash and crude fiber 18.1%. The level of digestibility of Tarramba is also the highest at 60-70%, the highest among various types of pods and other tropical forage. The study showed that the more Tarramba in basal feed the higher average daily gain (ADG) of PE goat. ADG of the goat feed the combination of 75% Tarramba and 25% mangrove leaves was 160.12 ± 59.61 g/head/day, higher compared to 136.31±29.898 g/day in the goat feed 50% Tarramba and 50% mangrove leaves [12].

Several contract farming strategies have been implemented for decades to increase farmers' population, productivity and income. Of all models applied, none has achieved the goals as planned. Examples of less successful programs as reported by Asshidiqi *et al*. [13] in which they found that the rate of return was very low. Gunawati *et al*. [14] also reported various obstacles to contract farming contract farming with farmer groups, including marketing difficulties, low communication between Company and farmers, the production process not following the plan and lack of supervision from the Company.

Table 2. Income opportunities for partner breeders with the A cooperation model

No	Items	2020	2021											
		12	1	2	3	4	5	6	7	8	9	10	11	12
1	Goat total weight	180	239	297	356	414	473	531	590	648	707	765	824	882
2	Weight gain	-	59	59	59	59	59	59	59	59	59	59	59	59
3	Weight gain/head	-	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.90	3.9
4	Weight/head/month	-	15.9	19.8	23.7	27.6	31.5	35.4	39.3	43.2	47.1	51	54.9	58.8
5	Total weight difference						702							
6	Value at harvest	31,100,000												
7	Profit sharing value	17,550,000												
8	Income/month	1,462,500												

Number of male kid goat = 15 heads; Average weight at 3-4 months of age = 12 kg; Total weight when farmers accept the goat = 180 kg; ADG = 130/gr/head/day; Fattening period at the farmer is 12 months

Table 3. Income opportunities for partner breeders with the B cooperation model

No	Items	2020	2021											
		12	1	2	3	4	5	6	7	8	9	10	11	12
1	Goat total weight	159	195	240	285	330	375	420	465	510	555	600	645	690
2	Weight gain		45	45	45	45	45	45	45	45	45	45	45	45
3	Weight gain/head		3	3	3	3	3	3	3	3	3	3	3	3
4	Weight/head/months		15	18	21	24	27	30	33	36	39	42	45	48
5	Total weight difference						540							
6	Value at harvest	32,400,000												
7	Profit sharing value	16,200,000												
8	Income/month	1,250,000												

Numbers 12 and 1 to 12 in row indicated moths; Number of male kid goats = 15 heads; Average weight at 3-4 months of age = 10 kg; Total weight when farmers accept the goat = 150 kg; ADG = 100/gr/head/day; Fattening period at the farmer is 12 months

Table 4. Income opportunities for partner breeders with the C cooperation model

No	Items	Result	Months						
			Dec	Jan	Feb	March	April	May	June
			Preg-2	Preg-3	Preg-4	Kidding	Lac-1	Lac-2	Lac-3
1	Reproduction period								
2	Number of life kid					14			
3	Kid total eight						42	84	154
4	Kid weight/head						3	6	11
5	Overall kid price	8,470,000							
6	Price per kid	605,000							
7	Profit sharing for breeders	6,970,000							
8	Mating cost	1,500,000							
9	Breeder income/month	1,161,667							

Number of pregnant nany = 10; Mating cost = 2,500/head/day; Male and female kids price were IDR 50,000/kg and IDR 60,000 per kg life weight

Table 5. The income of partner farmers according to the partnership model

No	Partner ID	Model	Total		Live weight (kg)			Profit sharing (IDR)		Partner income/month (IDR)
			Months	Goats	Beginning	End	Increases	Partner	SAN	
1	KE 2019 001	A	12	15	226.90	825.00	598.10	14,952,500	14,952,500	1,246,042
2	KE 2020 001	B (1)	6	15	231.30	450.00	218.70	5,467,500	5,467,500	911,250
3	KE 2020 001	A+B (2)	6	30	447.25	1,100.10	652.85	16,321,250	16,321,250	2,720,208
4	KE 2020 001	C (3)	6	24	0.00	336.00	336.00	10,920,000	5,880,000	1,820,000
5	KE 2020 004	A+B (1)	6	30	331.70	963.05	631.35	15,783,750	15,783,750	2,630,625
6	KE 2020 004	C (2)	6	23	0.00	336.03	336.03	11,088,990	5,880,525	1,848,165
7	KE 2020 002	C	6	12	0.00	144.00	144.00	7,200,000	0	1,200,000
8	KE 2020 003	A	6	15	202.45	518.00	315.55	7,888,750	7,888,750	1,314,792
9	KE 2020 006	C	6	22	0.00	313.81	313.81	10,198,825	5,491,675	2,039,765
10	KE 2020 005	C	6	22	0.00	303.70	303.70	9,870,250	5,314,750	1,974,050
11	KE 2020 007	C	6	17	0.00	215.40	215.40	7,000,500	3,769,500	1,400,100
12	KE 2020 008	C	6	23	0.00	225.60	225.60	7,332,000	3,948,000	1,466,400
13	KE 2021 009	A+B	6	30	329.35	865.85	536.50	13,412,500	13,412,500	2,235,417
14	KE 2021 010	A+B	6	30	483.95	1,100.49	616.54	15,413,500	15,413,500	2,568,917
15	KE 2021 015	B	2.5	20	232.30	356.52	124.22	3,105,500	3,105,500	1,242,200
16	KE 2021 011	C	6	29	0.00	393.90	393.90	12,801,750	6,893,250	2,133,625
17	KE 2021 012	C	5	26	0.00	263.70	263.70	8,570,250	4,614,750	1,714,050
18	KE 2021 013	C	4	27	0.00	200.70	200.70	6,522,750	3,512,250	1,630,688
19	KE 2021 014	A+B	5	36	409.43	868.7	459.2	11,480,500	11,480,500	2,296,100
		Average			152.35	514.76	362.41	10,280,582	7,848,971	1,810,126

Table 6. Population data on July 13, 2022

No	Gender	Age group	FB	F1	F2	F3	AF	LKL
1	Male	Mature	3	5	3	3	3	-
		Young	2	0	6	7	9	-
		Kids	5	19	6	6	43	-
		Subtotal (a)	10	24	15	16	55	-
2	Female	Mature	5	66	47	12	70	245
		Young	3	4	5	3	6	-
		Kids	4	21	15	12	42	-
		Subtotal (b)	12	91	67	27	118	245
Subtotal (a+b)					315			-
Total					560			

FB Full Blood, AF cross breed between F1, F2 and F3, LKL Local goat

Table 7. On-going contrack farming program Juli 13, 2022

No	Partner ID	Model	Number						Total
			Male			Female			
			Adult	Young	Kids	Adult	Young	Kids	
1	SAN-C	-	16	-	37	298	-	36	387
2	KE 2022 016	A/B		29				10	39
3	KE 2021 011	A/B			9			27	36
4	KE 2020 001	A/B			17			9	26
5	KE 2021 014	B/C			11	19		6	36
6	KE 2019 001	B/C			14	17		5	36
			28	29	78	334	-	91	560

Table 8. The projected population development of male and female Boer goats F1 to F6 in 2020-2025

No	Parent	Filial	Oct 2020		Oct 2021		Oct 2022		Oct 2023		Oct 2024		Oct 2025		% Boer Blood
			F	M	F	M	F	M	F	M	F	M	F		
1	Local	F1	90	61	61	102	102	170	170	285	285	478	478	50	
2	F1	F2	85	57	57	96	96	161	161	270	270	452	452	75	
3	F2	F3	20	14	14	23	23	38	38	63	63	106	106	87.5	
4	F3	F4	-	-	14	9	9	15	15	26	26	43	43	93.8	
5	F4	F5												96.9	
6	F5	F6												98.4	
7	F6	F7												99.2	
Total			195	132	145	230	230	385	385	644	644	1,079	1,079		

Learning from the failure of the previous model, the initial study conducted by this study recommends revising the contract farming model. There are three recommended models based on profit: male goat fattening, female goat fattening, and breeding, respectively. The results have been very satisfying for SAN-C and farmers for three years since these models were implemented. Puteri *et al*. [15] explained, the Decree of the Minister of Agriculture (2007) states that business contract farming's are one of the efforts to develop modern agriculture oriented to agribusiness. The contract farming is a business strategy carried out by two or more parties within a certain period to achieve mutual benefits with the principles of mutual need, mutual benefit, and mutual strengthening. The contract farming pattern that is generally implemented is the Core-Plasma contract farming which is a relationship between farmers, farmer groups, or partner groups as plasma, with core companies that have business partners [8, 16].

Typically, mostly farmers in WNT were the small farmers or agricultural landless take up goats as the main occupation [17]. Thus, according to [18], the existence of contract farming can provide various benefits for the parties involved, especially for breeders, namely obtaining consulting services on production methods, obtaining funds for capital, and obtaining new technology so that farmers gain new knowledge, and can minimize price risk and as a support for the opening of new markets. In addition, farmers who participate in contract farming's will generally have a higher level of profit than independent farmers who do not participate in contract farming's [18]. However, in some cases, it can also give the opposite result; namely, non-partner farmers are higher in profit than partner farmers [19]. Moreover, it is necessary to study the benefits of partnering with non-partners to find consistent and conclusive empirical results regarding the effect of contract farming [20]. However, the contract farming model is expected to increase production and profits for both parties.

So far, most of the goats in WNT are kept on part-time farms and in many cases, it is a non-profit oriented. They were kept by poor and landless people, rarely by land owners. Therefore, the productivity of goats has not received serious attention even though the potential for goat production, especially Boer cross goats, is very promising. The goat is easy to keep, cheap to purchase and quick to reproduce [12,21]. The results of this study found that the ADG of Boer cross goats from the recording of 15 weaning young goats, which were taken randomly from male and female Boer cross goats F1, F2 and F3 documented the average ADG was 144 g/head/day or 4,3 kg/head/month (Table 1).

The weight gain of Boer cross goats from this study is quite realistic compared to the results of studies reported by several researchers. The average daily weight gain of Boer cross goats at the age of 0-30 days was 201.33 g/day in male twins and 137.33 in female twins whose diet was 100% Sesbania Grandiflora leaf [7]. However, it is worth noting that the growth rates of single kids are visibly advanced over the two-litter birthing occurrence. The growth of pre-weaning kids is consistently faster than afterwards. Likewise, the nutrient requirement during doe pregnancy is altered depending on single, twin, or triplets carried. In the same way, nutrient supplements vary for a nursing doe depending on the number of kids in care. The Boerka goat from the cross between the Boer goat and the Kacang goat has good characteristics as a meat goat. Live weight (birth, weaning, ages 6, 9, 12, 18 months and adults) was 33–48% higher on average than Kacang goats [21]. So, the ADG of Boer Cross goats documented by SAN-C are quite realistic because the weight gain is twice that of the ADG of kacang goats whose doe are fed field grass.

The report on the growth of Boer cross was in line with the reports of [22] and [23] respectively for the Boer cross in Egypt and Turkey. Different results were seen in the results of a study by Tesema el al. [24], namely the kid's cruciferous genotype with a composition of 25% Boer showed higher pre-weaning growth than the genotype with a composition of 62.5 and 75.0% Boer.

In general, breeding goat in WNT was based on the knowledge and capabilities of the goat owners, inbreeding the method of

reproduction is common. Therefore, SAN-C began to pioneer a planned and centralized breeding process at the Breeding Center in Tiu Borok, East Lombok Regency. Several researchers reported that ennobled local goats with Boer goats were proven to increase the productivity of their crosses [7,9,17,18]. Zaenuri *et al.* [7], reported that from 20 nannies 18 of them gave birth to 34 heads consisting of 6 single males, 12 single females, 8 male twins, 2 female twins and 6 male-female twins. Length of Pregnancy (days) Single male (152±0.47) male twins (152±2.00) or longer than single female, female twins and male twins, namely 149±3.82; 150±3.94; 147±2.94 days.

The results of another study reported that the average length of pregnancy in single kid was 156.83±6.08 [23], and twin's kids were 147.7- 154.6 days [24]. Furthermore, [7] stated that the greater the number of kids conceived, the duration of pregnancy tends to be shorter. Parturition in singleton births occurs with a longer time span of 144 to 158 days. While parturition in the birth of twins 2 occurs with a shorter time span of 142 to 151 days. Radiayati *et al.* [25] reported that, parturition occurred in the range of 142 to 158 days of fetal age.

The current population noted 560 of which 315 were Boer cross various filial and the rest were Local goats (Table 6). All of those goats were on going recent contract farming program (Table 7). From the various descriptions above, SAN-C and the Research Team have made population development projections of male and female goats of various filial Boer crosses (F1–F6). The population of Boer cross goats is projected to increase from 195 F1 to F3 in 2020 to 1,079 males and 1,079 females in 2025 (Table 8). From this projection, the number of partner breeders will also increase yearly. Likewise, the stock of Boer cross will increase significantly and become a source of stock breeders for other districts in WNT. With the support of a relatively large area for the Tarramba tree, the problem of feed availability will no longer be a major obstacle. With the mutually beneficial contract farming between SAN-C and partner breeders, the sustainability of the Boer cross-goat development becomes more certain.

CONCLUSION

SAN-C has succeeded in changing the previous contract farming model that was more social in nature with recent contract farming model in which to be profit-oriented and profitable for both parties. It is recommended that the recent contract farming model can be applied to the other farmers in all over WNT. It was also recommended that SAN-C make a selection for F2 and F3 with the most superior phenotypes as stock breeders. Finally, excess feed production in the rainy season should be stored in the form of hay or silage to overcome shortage of feed in the dry season.

CONFLICT OF INTEREST

The authors have no conflict of interest with any financial organization regarding the material discussed in the manuscript.

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