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Management of St. Croix Sheep and Garut Sheep Genetic Resources in Sheep Formation

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ABSTRACT

This study aimed to determine the management of the genetic resources of St. Croix sheep and Garut sheep in the formation of sheep clumps and their physiological conditions. The study was conducted at the Livestock Research Institute on Jalan Raya Pajajaran Bogor, West Java, in 2019. Ex-situ collection materials and characterization of St. Croix sheep and Garut sheep were as many as 250 heads; sheep breeding was carried out in groups; one male married 5-10 heads. The rams were left in the mating group for two oestrus cycles (34 days). Primary data and secondary data were analyzed descriptively and quantitatively. The results were obtained in the germplasm research of St. Croix with an average mating body weight of 23.45 ± 4.08 kg and Garut sheep of 26.20 ± 4.92 kg. The average birth weight of St. Croix sheep was 2.26+0.35 kg, and Garut sheep was 2.05± 0.47kg. The establishment of the St. Croix and Garut sheep have high genetic quality, production, and reproductive characteristics, but each has a different productivity level. The study of germplasm preservation of sheep was carried out to increase the population of St. Croix sheep and pure Garut sheep so that the maximum target population of >200 sheep was achieved to meet the demand for seeds as animal food.

Key words: sheep genetics, the formation of sheep breeds

introduction

Sheep are local Indonesian sheep breeds and have been widely cultivated by rural communities. Their maintenance is passed down from generation to generation, becoming a wealth of Indonesian local livestock genetic resources (Directorate of Livestock Breeding and Production 2018). Sheep are small ruminants that have a later in their maintenance, easily adapt to the environment and breed quickly (Malik and Sutirman, 2015). According to Sutiyono *et al.*, (2010), the basis of selection in sheep is not seen in the body size of sheep, and also not affected by fat and skinny sheep. Sheep germplasm is one of the activities in preserving biodiversity in livestock genetic resources (SDG). Preservation of livestock is always needed in breeding as raw materials in the future. One of them is the germplasm livestock in the Livestock Research Institute, the St. Croix and Garut sheeps. The depletion of local livestock SDGs needs to be watched out for because flocks or types of sheep can be formed through breeding programs or biotechnology. The genetic resources of sheep can be done by forming a clump of sheep assemblies of SDGs, a clump of the past.

These changes can be believed that the SDGs have enormous benefits for human life. Conservation of biodiversity (SDG) in sheep, will always be needed in livestock breeding in the future. Without genetic diversity, sheep breeding is impossible (Subandriyo et al., 2010). If an SDG becomes extinct, then we cannot re-form it, even though we have not fully mastered the genetic potential of the sheep it contains; therefore, it is necessary to understand the conservation of livestock SDG, it must be connected with an understanding of nature and the possibility of changes in livestock genetics in the future will bear fruit. To produce sheep as feeders both for spells and for seeds, it can be done through Science and Technology (IPTEK), reproductive technology, and one of the reproductive technologies that have been widely carried out and developed through Artificial Insemination (AI) (Hasan et al., 2017). Thus, sheep are a source of germplasm genetic power livestock, which can be developed and sustainably maintained for its development. This can be done by improving the genetic quality of the sheep nation nationally while retaining the purity and sustainability of the livestock (Sumantri et al., 2007).

Maintaining the diversity of sources The genetic resources of sheep are very important because St. Croix Sheep, a type of hair sheep, were imported from the Virgin Islands, United States of America and used as one of the materials for the formation of superior sheep carried out at Balitnak. While the Sheep of St. Croix has been around since 1986 and has adapted to the tropical climate of Indonesia, the St. Croix sheep are in the process of being established as a new family of local Sheep

(Subandriyo, 2016). Inounu *et al.* (1999) reported crossbreeding between Garut local sheep, St. Croix from the Virgin Islands (America), and Moulton Charollais from France. They showed that the body weight of single heads from local and crossbred heads did not statistically differ, either in males or females. On average of both types of sheep, the weight of local heads is lower than that of the heads from the cross.

Usually, in sheep rearing there is always death in heads, the possibility of death is due to competition for mother's milk between heads, other things are lack of mother's milk (Somanjaya *et al.,* 2015). Crossbreed local sheep with livestock import, has been done a lot in Indonesia, however, the results have not been satisfactory (Rahmat et al., 2006). Crossed local sheep have a different direction and clear purpose, whether for productivity or the germplasm of sheep. Superior livestock in their native areas have good genetic interactions and are compatible with their environment. But not necessarily able to adapt and excel new area. Henceforth the hair sheep in the Virgin Islands is the St. Croix sheep. Indonesian sheep consists of two clumps, thin-headed Sheep and fat-headed Sheep, with several strains for each breed, especially for the thin-headed type.

The origins of local Sheep in Indonesia are not known with certainty, but it is possible that the thin-headed sheep came from India or Bangladesh, and the fat-headed type and is thought to have come from West Asia (Bradford and Inounu, 1996) in (Subandriyo et al., 2016). According to Firman et al. (2018), sheep are livestock that can breed well and survive in all agroecological zones, spreading throughout Indonesia. Sheep have many regular cycles and are taken into consideration by government policies to develop sheep and facilitate sheep business (Rusdiana and Adiati, 2018); (Rusdiana and Adiati, 2020). Based on the problem, the St. Croix and Garut sheep as germplasm assets and have the potential to be developed as a source of meat food. This research aims to know the management of St. Croix and Garut sheep in clump formation as sheep's genetic resources.

MATERIALS AND METHODS

Location and Time of Research

The research location was in an experimental sheep enclosure on Jalan Raya Pajajaran, Bogor, West Java in 2019. The research location was land-based forage fodder deliberately cultivated for sheep's feed needs. Bogor sheep breeding cage was established in 1979 until now and has produced many superior sheep. Many have been released in the community, both on the island of Java and outside Java.

Data Analysis

Primary data were obtained from the experimental station for sheep livestock in Bogor. Secondary data is obtained from supporting data for research results that have been reported and from related information according to research titles, journals, and proceedings, whether published or not, as well as their ideas and thoughts. Primary data and secondary data were analyzed and tabulated descriptively and quantitatively.

Collection, Characterization of St. Croix and Garut Head Sheeps as SDG Potential.

Ex-situ collection and characterization were carried out at the experimental station of the Livestock Research Institute, Jalan Raya Pajajaran Kav E-59, Bogor, West Java, with a total of 250 St Croix and Garut sheep. The research was carried out as follows: (1) adult female Sheep and males are put together in one cage or groups, and males can mate between 5-10 broods. Males were left in the mating group for 2 (two) estrus cycles or for 34 days, (2), sheep received concentrate feed of about 0.5 kg/head depending on the physiological phase of livestock, and forage fed as much as 4 kg/head/day. Mineral blocks were provided to complement the needs of sheep for micro minerals, (3) the weight of the brood is weighed once a month until 3 (three) months of gestation, at the time of birth and lactation. Weighing of pre-weaned is carried out every 2 (two) weeks, and (4) sheep slag weaning is carried out when the heads are 90 days old.

Provision of drinking water to sheep on an *ad libitum basis* then characterizes sheep biologically and morphologically by collecting production performance data such as changes in body weight on various physiological statuses of livestock. Child production and broodstock productivity, reproductive performance, pregnancy rate, litter size, birth weight, weaning weight, child viability, and growth rate. Linear statistics was used to analyze data.

RESULTS AND DISCUSSION

Regional Support Power

The area of Bogor City, West Java Province, has an excellent geographical location, is very strategic, and has become the principal capital for developing the economy of the Bogor City area. The land's carrying capacity is primarily urban, with hotels, offices, markets, shops, and culinary arts such as goat satay. Technology is strongly influenced by various environmental factors, namely the ability of the farming community to increase their business, sheep cultivation, and trade. Efforts made by the people of Bogor City have a positive impact whose aim is to increase economic value and improve their lives, so the technology offered will be immediately welcomed by breeders. It won't be accepted or just normal if it doesn't have a positive impact. Bogor City resident's livelihoods are office workers, entrepreneurs, employees, civil servants, trade, and other laborers (Bogor City Livestock Statistics 2018)

Characterization of Sheep as SDG Potential

Sheep population of St. Croix in Bogor livestock trial enclosure, at the beginning of 2018 as many as 110 heads, consisting of 66 adult sheep, 12 young and 32 heads born in 2017. The population of Garut sheep in early 201 8 as many as 141 of them are adult sheep, 63 young, 22 heads, and 56 children born in 2017. The sheep population existed at the beginning of 2018, and at the end of 2018, a population decline of 40%. It was because some of the sheep were transferred to the Cicadas experimental pen as acceleration livestock as many as 13 heads. Changes in the population of St. Croix sheep and Garut sheep in the practical cage in Bogor are shown in Table 1.

Table 1 shows changes in the population of St. sheep. 2018 Croix in the experimental cage, mutated to Cicadas for accelerated research and partially posted. The transfer of the Garut sheep as livestock was accelerated. Some of them were distributed or disseminated to the community or breeders, such as Tegal-Central Java, and some livestock died. St. Croix sheep and Garut sheep in Bogor Experimental Stable are bred or reared for observation as the formation of pure germplasm for sheep.

Table 1. Sheep population changes

Description	St. Croix Sheep Average ± SD	Garut Head Average ± SD
Initial amount	110 ± 9.17	141 ± 11.75
Sheep mutation	13 ± 1.03	13 ± 1.03
Disposal/dead	24 ± 2.07	25 ± 2.08
Final amount	44 ± 2.08	62 ± 17

To increase sheep's productivity, each germplasm's feed supply is quite diverse. The provision of concentrate feed and forage is adjusted to the condition of livestock, pregnant females, children, males, and livestock that have just given birth. Concentrated feed for each animal is given as much as 0.5 grams/head/day, so the feed needs for sheep are met.

According to Siswati et al. (2015) and Perwitasari and Bastini (2019) that, technically, sheep have a reasonably good tolerance for forage feed and can adapt well to tropical environments. Of the sheep population at the end of December 2018, as many as 106 heads came from St. Croix and 62 ± 5.17 heads and Garut sheep 44 Sheep ±3.67 heads. When divided based on their physiological status, St. Sheep Croix only 2.27% of male sheep and 13.64% of young males, 63.64% of broods, and 20.45% of young females. Therefore, the minimum population standard for breeding as many as 50 lines is very far from being fulfilled. The physiological status of germplasm sheep is shown in Table 2.

Table 2 shows that the physiological status of St. Croix experienced things that were not much different from Garut. Based on their physiological level, the male sheep are 4.84%, the young male is 14.52%, the parent is 46.77%, and the young female is 33.87%—minimum target population. The sheep germplasm activity is carried out to increase the population of pure livestock so that the maximum target population of >200 sheep meets the demand for St. Croix sheep breeds and Garut sheep as animal food.

Table 2. Physiological status of sheep

Physiological Status of Livestock	End of 2018	
	St. Croix Sheep	Garut sheep
Male (head)	1±0.08	3 ±0.25
Young male (head)	6 ±0.05	9 ± 0.75
Lamb (head)	-	-
Number of male livestock (heads)	7 ±0.08	12 ±1.00
Parent (head)	28 ±2.33	29 ±2.42
Young Female (head)	9 ±0.75	21 ±1.75
Daughter (head)	-	-
Number of female livestock (head)	37 ±3.08	50 ±4.17
Total flock of sheep (head)	44 ±3.67	62 ±5.17

Mortality and Reproductive Performance

Mortality in sheep is very closely related to productivity; pre-weaning mortality is influenced by genotype, birth type, parity, and season, but not by sex of sheep. The mortality rate during 2018 in adult sheep, both St. Croix by 54.64% and Garut sheep by 39.81%, is relatively high, as well as what happened to the head that was born. Performances in St. Croix sheep. and Garut sheep have a reasonably high genetic quality but have different productivity levels for production and reproductive traits. The result of germplasm research of St. Croix and Garut sheep mated as many as 35 heads, with an average weight of St. Croix by 23.45±4.08 kg, and 40 heads, and the average weight of the mating mother Garut by 26.20±4.92 kg.

Of the pregnant mothers, 87.5% of the St. Croix sheep breeds with an average parental weight after calving 23.90 ± 3.31 kg, and 79.49%. Meanwhile, Garut heads gave birth with an average parent weight of 28.08 ± 3.46 kg. in St. Croix, and garut Sheep, which are not 100% pregnant because many female sheep miscarry at about three months pregnant. Meanwhile, for Garut heads that gave birth to 17.30 % of mothers gave birth to a single child, 53.85 % of twins, and 28.85 % triplets with an average litter size of 1.68, litter size range of 1-3 heads. Miscarriage is caused by lacking feed and colliding with other livestock when fighting for food. The reproductive performance of the St. Croix and Garut germplasm ewes is shown in Table 3.

Table 3 shows that the percentage of mortality (mortality) of heads in the pre-weaning period is between 0 - 3 months; in St. Croix sheep, it is very high at 16%, and in Garut sheep at 16 %. From newborns and pre-weaning children who died, characterized by weak symptoms at birth, they were pushed and stepped on by other sheep. The results of Adiati and Priyanto's research (2011), the percentage of pre-weaning child deaths is 38.02 % which occurs in single children at 18.2%, twins two by 45.8 %, twins three by 57.1 %, and twins at 75 %, higher. The possibility of death is due to premature birth, stumbling, the mother does not want to breastfeed, or the mother does not have milk due to insufficient feeding, so the impact on children who are born unhealthy. St. Croix sheep and Garut sheep for survival, especially in heads, are essential parameters in the development of their productivity.

Table 3 . Sheep's reproductive performance

Parental reproductive performance	St. Croix Sheep	Garut Sheep
Parent mating (head)	35	40
Percentage of pregnancy (%)	67.71	97.5
Liter size	1.05 (1- 2 heads)	1.68 (1-3 heads)
Single birth rate 1 (%)	00.91	17.30
T twin birth rate 2 (%)	9.09	53.85
T twin birth rate 3 (%)	-	28.85
Sex ratio (male: female)	36 : 64	37 : 63
child death (head)	16 ±1.22	16 ±1.23
Weaning mortality (%)	77.27	40.38
Mating parent weight (kg)	23.45 ± 4.08	26.20 ± 4.92
Parent weight (kg)	23.90 ± 3.31	28.08 ± 3.46

The low mortality rate can demonstrate the viability of sheep in a population in heads. Mother of St. Croix sheep who managed to get pregnant was 67.71%, while the Garut ewes were better at getting pregnant, which was 97.5%. In St. Croixes, Almost all gave birth to singletons of 90.91%, and 9.09% of twins were born with an average litter size of 1.05. The results showed that the average litter size obtained did not differ much (relatively the same) compared to that reported by Subandriyo et al. (2000), which is 1.48%. In general, it shows reproductive performance, especially the number of offspring born of Garut sheep, including sheep with moderate proliferation with relatively stable prolification ranging from 1.30 to 1.52. The male and female sex ratio is 36: 64 % for the St. Croix and 37:63% for Garut sheep.

In the following year, germplasm activities will be carried out to increase the population until the minimum population target is achieved, and if there is a demand for St. Croix can't give it yet. Meanwhile, the condition of the young males still takes a long time to be ready to become rams because the livestock is small due to lack of feed. St. Croix sheep can be used to renew the blood of Compass Agrinak sheep that have been released. Several subtropical sheep breeds from Europe (Netherlands, England, Australia and New Zealand) were introduced to Indonesia about 150 years ago (Merkens and Soemirat 1926) and (Subandriyo et al., 2016). Thus, the genetic contribution of these imported sheep is minimal, as shown by the body size and characteristics of local Indonesian sheep-the largest concentration of thin-headed sheep in each region, especially in the province of West Java.

Thin-headed sheep are known as Priangan sheep or called Garut sheep and are often used as fighting sheep, and Thin-headed sheep are from Garut and Bogor. Thin Head sheep from Garut is bigger than Thin Head sheep from Bogor. Efforts to increase the body weight of local lamb by mating through crosses or crossing with fellow tropical sheep with good body performance. St. Croix sheep, Sumatran, and Garut composites have been widely used for crossing Thin-Headed sheep and carried out at the Bogor sheep breeding station. Adiati and Priyanto's research (2011) shows that pregnancy in AI synchronized sheep is 83.02%, while the birth rate is 75.7%, with the number of children producing as many as 82 heads and the number of children born (JAS) of 1.55. Crosses between local sheep and superior sheep from the Bogor Livestock Research Institute (Balitnak) showed that the resulting head has a reasonably high body weight growth rate (Adiati and Priyanto 2011). The appearance of the crossed heads is close to the appearance shown by imported pure sheep. However, for the preservation of the germplasm of the crossed sheep, it can be preserved according to the sheep clump in each region.

Head Rate

St. Croix sheep group and Garut showed that of the five mating groups, the best fertility on the Sheep of St. Croix is a mating group of 2, giving a yield of 85.7% parental percentage. Meanwhile, in Garut sheep, all mating groups showed high fertility, which was above 60%, and the best fertility occurred in mating groups 1 and 2, with the percentage of mother and offspring at 87.5%. Percentage of broodstock and head rate in the breeding group of St. Croix sheep and Garut are shown in Table 4.

Table 4 shows that judging from the number of children born, only group 4 gave birth to twins in St. Croix sheep and others produced an only child. Meanwhile, in Garut sheep, all mating groups gave birth to twins, twins two and twins 3. Meanwhile, the heading rate was calculated based on the number of children born divided by the number of parents mated and showed that the best heading rate was the mating group of 2 (two) Sheep. St. Croix was 0.86, the mating group was 1 (one) in Garut sheep, and the mating group was 2 (two).

Production St. Croix and Garut

The number of germplasm heads born in 2018 was 74 (22 St. Croix heads and 52 Garut heads). The difference between birth weight and weaning weight in sheep is due to the presence of different genetics of Sheep and environmental influences. According to Santosa et al. (2006), sheep's birth weight and weaning weight are influenced by age, parent body weight, when pregnant, and the feed given. The average birth weight of heads varies greatly and depends on the sex and type of birth. Mean Birth Weight per St. Croix head and Garut Germplasm sheep are shown in Table 5.

Table 4. Percentage of broodstock and head rate in the mating group

Livestock Clump	Mating group	Number of parents mated (heads)	Number of Parents (head)	Percentage of Parent calving (%)	Number of children born (head)	Head rate
St. Croix	1	7	3	42.9	3	0.42
	2	7	6	85.7	6	0.86
	3	7	4	57.1	4	0.57
	4	7	4	57.1	5	0.71
	5	7	4	57.1	4	0.57
Amount		35	21	-	22	-
Average				59.98		0.63
Garut	1	8	7	87.5	16	2
	2	8	7	87.5	9	1.13
	3	8	5	62.5	11	1.38
	4	8	6	75	8	1
	5	8	6	75	8	1
Amount		40	31		52	
Average				77.5		1.30

Table 5. Average birth weight per head

Variable	N	St. Croix sheep	N	Garut sheep
General Average (kg)	22	2.26 ± 0.35	52	2.05 ± 0.47
Gender				
Female (kg)	14	2.25 ±0.43	33	1.99 ± 0.52
Male (kg)	8	2.29 ±0.16	19	2.15 ± 0.32
Birth Type				
Single (kg)	20	2.34 ± 0.20	9	2.48 ± 0.52
Twins -2 (kg)	2	1.50±0.71	28	2.15 ± 0.12
Twins -3 (kg)		-	15	1.60 ± 0.51

Table 5 shows that, from the total number of children born to St. Croix sheep, the average birth weight was 2.26 ±0.35 kg; in Garut sheep, it was 2.05 ±0.47 kg. St Croix sheep and Garut sheep, the number of female offspring is more than the male offspring. Rahmat's research results et al., (2006) sheep from a cross between Barbados. Sheep with P light sheep birth weight of 42.56-46.60% and weaning weight of 31.90-56.27% for both males and females, the birth weight of male offspring is usually higher than that of female. Classification of Sheep by type of birth shows that, with the increasing kind of birth, birth weight tends to decrease due to miscarriage. Preservation of sheep germplasm with an average gestation of 5 months or 44-152 days. Weaning of St. Croix and Garut heads, collected at three months or 90 days. The weaned sheep have stopped breastfeeding and can consume grass and concentrate.

The age limit for ewes and male sheep to be reared by breeders or for research, the age of St Croix sheep and Garut sheep can be bred for five years for females and 6-8 years for males being rejected. St. Croix and Garut sheep are critical criteria that can determine the economic value of sheep to increase (Sodiq 2010). The exterior of the sheep's body of various ages can be. It is estimated that the number of carcasses and the abdominal cavity area is height, body length, chest circumference, and hip-width. Research results by Heriyadi et al. (2012) showed that the quantitative traits of male Garut sheep have an average body weight of 57.74 kg, body length of 63.41±5.72 cm, and chest circumference of 88.73±7.58 cm. St. Croix sheep and Garut sheep have excellent reproductive properties and breed quickly. Preservation of plasma germ of sheep is a joint task, and efforts can be made to develop more genetically; besides that, sheep have a comparative advantage compared to imported Sheep (Ngadiyono et *al.*, 2009).

CONCLUSION

Based on the research on sheep, it can be concluded that the formation of the St. Croix sheep breed and Garut sheep have high genetic quality. The production and reproductive characteristics of St. Croix sheep and Garut sheep have different productivity levels. The study of germplasm preservation of sheep was carried out to increase the population of St. Croix sheep and pure Garut sheep so that the maximum target population of >200 sheep was achieved to meet the demand for seeds as animal food.

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