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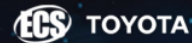
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Application of reproduction and production technology of goat livestock to improve living standards of the people of Dayow Village, Pinolosian Timur Subdistrict, Bolaang Mongondow Selatan Regency

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Abstract. Dayow Village has abundant and potential local resources (such as livestock and agricultural plantations) but has not sufficiently increased the income and welfare of the community due to the isolation of the region which has implications for the limited variety of accessibility of community life. A Community Service Program, The Application of Appropriate Technology Program (PPTTG) scheme has been held in Dayow Village with the aim to 1) increase community knowledge and skills in mastering the technology of reproduction and production of goat livestock, and in processing livestock waste into solid and liquid organic fertilizer; and 2) increase community economic income. The method used as a form of community empowerment in Dayow Village is a combination of methods of application of sciences and appropriate technology of superovulation to improve the reproduction of goats. The results of this activity show that the superovulation technology products, which are the results of research and development of the implementation team, can be applied to meet the needs of the people of Dayow Village. This activity can increase regional potential and community participation.

1. Introduction

1.1. Situation analysis

Dayow Village is one of the outermost and remote areas which is located in Pinolosian Timur Subdistrict, Bolaang Mongondow Selatan Regency, Sulawesi Utara Province (figure 1). According to *Indeks Desa Membangun* (IDM) in 2015, Dayow Village is categorized as *Desa Sangat Tertinggal* (very left behind village) with an index value of 0.47759 (villages are classified as very left behind if the index value is ≤ 0.491) [1]. The very left behind villages are villages that experience vulnerability due to economic shocks, natural disasters without prompt and appropriate handling, or prolonged social conflicts [1] so that they are unable to manage their potential in social, economic and ecological resources, and also experience poverty in various forms [2]. Dayow Village is also one of the 40 pilots.



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villages determined by *Kementerian Koordinator Bidang Pembangunan Manusia dan Kebudayaan*, so these villages are directed to become a priority for the *Kuliah Kerja Nyata (KKN)* program for several State Universities as a form of contribution from *Kementerian Riset, Teknologi, dan Pendidikan Tinggi* at the village level [3].

Dayow Village is very potential for the development of community livestock business because there is a vast land available which serves both as a place for raising livestock and providing food through agriculture, plantations and food crops. Several types of livestock have been cultivated by the people of Desa Dayow, such as ducks, free-range chickens, cows, and goats (figure 2). As agriculture and plantation crops become the foundation for community economic fulfilment, although these businesses have the potential to be developed, livestock businesses have not yet had a significant influence in improving people's welfare.

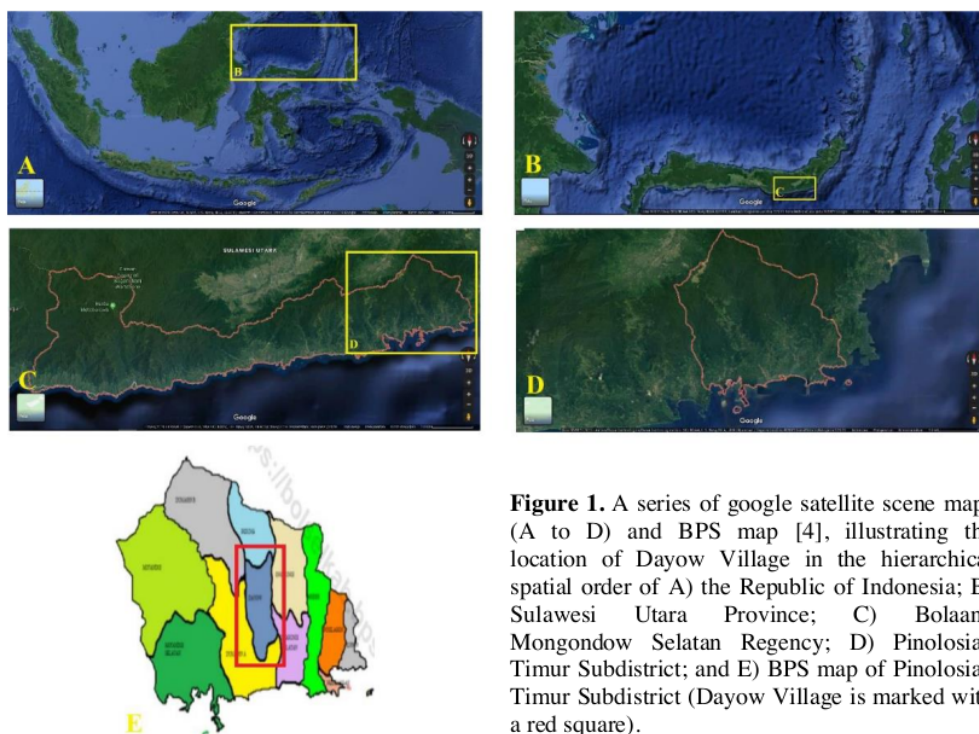


Figure 1. A series of google satellite scene maps (A to D) and BPS map [4], illustrating the location of Dayow Village in the hierarchical spatial order of A) the Republic of Indonesia; B) Sulawesi Utara Province; C) Bolaang Mongondow Selatan Regency; D) Pinolosian Timur Subdistrict; and E) BPS map of Pinolosian Timur Subdistrict (Dayow Village is marked with a red square).

One of the popular livestock businesses and dominantly maintained by the community is goat livestock. The goat livestock business has not contributed significantly to the economy of the community because of its low productivity. Although as a prolific animal, the availability of local goats as suppliers of animal protein needs is not comparable with market demand, especially on religious holidays. Two dominant factors influence the low productivity of local goats, external factors related to the availability of adequate nutrition in terms of quantity and quality, and internal factors related to quality or efficiency reproduction in producing superior offspring

External factors, in the form of availability of adequate feed-in quantity and quality, is one of the determinants of optimal goat breeding. Naturally, the feed intake of goats and other ruminants is highly dependent on the availability of forage in the form of grasses and leaves that grow and are

available wildly as well as some types of cultivation. The nutritional needs of goat livestock that are cultivated by the Dayow Village community are very dependent only on the level of availability of forage in the field and on the ability of goats to graze. Thus, although natural forages are available and very diverse, the availability does not fully meet the standard nutritional requirements for survival. Especially when it comes to prolonged dry season goats whose lives are very dependent on natural forage will experience nutrient-prone conditions and even malnutrition. One method that can be applied to anticipate this problem is the semi-ranch or sedentary housing technology [5-6].



Figure 2. Picture of livestock farming developed by the community in Dayow Village before the PPTTG activities were carried out.

Internal factors that determine the optimization of goat productivity are closely related to the physiological processes of livestock. The low productivity of local goats is caused by the low ability of broodstock to produce the number and or weight of offsprings in a reproductive cycle. The low productivity can be characterized by the high diversity of the number of offspring per goat broodstock. There is a tendency that the more twins born in a reproductive period, the more significant the percentage of offspring born under normal weights. This tendency is more influenced by the traditional way of raising livestock being released freely in the field. In addition to the standard nutritional needs not being met, this method of maintenance also provides opportunities for inbreeding which results in a decrease in the genetic quality of goats. One method that can be applied to anticipate this problem is reproductive manipulation technology ranging from improving follicular function to enhance ovulation, re-functionalization of uterine and placental to be able to mediate the optimal growth and development of the embryo and fetus, and enhance the growth and development of the mammary glands during pregnancy to produce milk optimally during the lactation period [7-8].

1.2. Problems faced by partner communities

Starting from the description of the situation analysis, some of the main problems faced by the community in Dayow Village are:

- 1) very low levels of reproduction and productivity of livestock farming as an accumulation of a lack of knowledge and skills in goat farming; and
- 2) goat farming which is cultivated by the community is still traditional as a result of the lack of mastery of knowledge, technology and skills in improving the reproduction of goats and in applying semi ranch housing technology.

1.3. Objectives and goals

1.3.1. Objectives. The objectives of PPTTG activities are as follows:

- 1) increase knowledge and skills in mastering reproductive technology to improve goat reproduction and productivity;

- 2) increase knowledge and skills to process livestock waste such as feces, urine and food waste into solid and liquid organic fertilizer; and
- 3) increase the economic income of the community.

1.3.2. *Goals.* The goals of PPTTG activities are as follows:

- 1) an increase in the number of people in Dayow Village (15-20 per cent) who gained knowledge, technology and business skills in goat livestock;
- 2) facilitated the procurement of 10 female and two male superior broodstock goats;
- 3) produce substantial (0.25 tons) and liquid organic fertilizer made from goat manure waste; and
- 4) facilitated life skill program of goat livestock business based on semi ranch system.

2. Methodology

2.1. Stages of activity

For the general public who are members of the Sehat Group, the approach applied is a combination of adult learning approaches (andragogy) [9], application of appropriate technology [10], also accompanied by a pilot project of the semi-ranch system of goat livestock. The stages of activities carried out include socialization, dissemination, and work practices.

2.2. Description of applied technology

2.2.1. *Production technology.* The technology applied to overcome the problem of goat production is semi ranch housing technology. This housing complex has two parts; the first part is the main cage in the form of a stage cage with bamboo floor cage, then underneath the concrete floor which is designed in such a way as to support efforts to obtain urine and feces as fertilizer raw material. To get urine, then on the front side of the cage is made a channel where at the end there is a hose that drains urine into the storage container, then put in a fermentation container for the process of making fertilizer. In contrast, faecal droppings and leftover food are immediately accommodated in fermentation containers for making solid organic fertilizer. The second part is a courtyard surrounded by a fence (semi ranch or sedentary [5-6]). The main purpose of the semi ranch enclosure is to limit the occurrence of inbreeding, also to provide natural environmental conditions in which plants are available as a food source as well as a source of food for the survival of goats. The cage yard not only functions as a place for exercise but also for planting food crops (corn and beans) and as a source of forage. The exercise yard will be divided into two plots which aim to rotate plants that allow the availability of food and feed raw materials.

2.2.2. *Reproduction technology.* To overcome the problem of low productivity of goat livestock business, then cross-breeding control techniques and superovulation technology are applied. The cross control technique was carried out to restore genetic material of superior goats that had undergone inbreeding. Therefore, in this activity, besides using residents' goats, superior male and female goats are also introduced. The application of superovulation aims primarily to improve the appearance of reproduction and production of goats that have undergone inbreeding. Superovulation agents used are the hormones PMSG (Folligon, Intervet, North-Holland) and hCG (Chorulon, Intervet, North-Holland). For uniformity of lust prostaglandins (Prosolvin, Intervet, North-Holland) are used. The application of superovulation technology aims to improve the productivity of broodstock by restoring superior goat genetic material, among others by manipulating reproduction starting from improving follicular function to improve ovulation, re-functionalization of uterine and placental to be able to mediate the growth and development of the embryo and fetus optimally, which in turn is able produce offsprings with optimal weights [7-8].

2.3. Operational work procedures

2.3.1. *Program socialization.* This section is more emphasized on the effort to introduce technology applied to the farming community in particular to convey information about the importance of raising goats with marginal land use, home yard and schoolyard. This activity is also a media to transform the picture of science and technology to solve the problems faced by the target.

2.3.2. *Education and assistance for goat farming.* The implementation team will educate and assist the target groups in a series of processes ranging from the design and manufacture of semi ranch cages, the application of superovulation reproduction technology, and controlled cross-breeding.

2.3.3. *Introduction of superior male and female goat breeders.* As has been explained that this activity seeks to improve the productivity performance of goats, the next step taken is to introduce superior female and male broodstock.

3. Results and discussions

A community service activity through the PPTTG scheme has been carried out in the context of developing a goat livestock business in Dayow Village, East Pinolosian Subdistrict, South Bolaang Mongondow Regency. This community service activity has a double meaning, in addition to overcoming the problem of low productivity of the people's livestock business, as well as an effort to increase economic income to alleviate poverty in the border areas.

These community service activities generally contain the intention to carry out the mandate of Law Number 6 of 2014 concerning Villages, which among others aims to improve the quality of human life, as well as poverty alleviation, through the provision of basic needs fulfillment, building facilities and infrastructure, developing local economic potential, and sustainable use of natural resources and the environment. This activity, as well as an effort to participate in realizing *NAWACITA* of the President of the Republic of Indonesia, especially the third *CITA*, which is committed systematically, consistently and continuously to make rural areas become developed, strong, independent and democratic regions. Thus, through this program, the development of rural areas is supported by all components; in this case, Higher Education, especially Universitas Negeri Manado to be able to improve the welfare of the community.

3.1. Outputs

Through PPTTG activities, several outcomes have been obtained, including

- 1) facilitation of providing technology in the form of a unit of semi ranch goat cage (figure 3);
- 2) facilitation for the introduction of 10 females and two males of superior goat (figure 4A-C);
- 3) the transfer of knowledge and skills to process livestock waste in the form of feces, urine and leftover food into solid and liquid organic fertilizer; and
- 4) facilitation of technology transfer of reproductive and production processes of goats livestock for the community (figure 4D).

3.2. Outcomes

Through PPTTG activities, a technology package has been facilitated in the form of goat farming, with several important benefits to be gained. Success criteria based on the results obtained, namely, through PPTTG activities, there is an increase in the capacity of partner group resources, especially related to the understanding and mastery of knowledge and technology of goat farming. Based on the results of the evaluation, around 90 per cent of the population initially did not know the technology of goat farming and processing animal manure as organic fertilizer. But through PPTTG activities, the number of people getting knowledge and skills has increased significantly. The superovulation technology

products, which are the results of research and development of the implementation team, can be applied to meet the needs of the people of Dayow Village.



Figure 3. The process of making semi ranch goat pens: A) procurement of materials and tools for making cages; B) installation of cage foundation pole; C) installation of cage roof; and D) completion of cage construction.



Figure 4. The process of introduction of male and female goat breeders: A) transport of goat breeders from Manado to the location of PPTTG in Dayow Village; B) the supply of feed ingredients during the transportation process; C) goat breeders placed in semi-ranch cages; and D) technology dissemination of goat farming by the Chairperson of the Implementation Team.

3.3. Lesson learned

The goat livestock business carried out by the Dayow Village community was initially traditionally so that it had an impact on low productivity. Dayow villagers generally try to meet the nutritional needs of livestock only on the availability of forage around the rearing place and on the ability of goats to graze. In addition to feeding, sometimes people only provide straw of field rice and corn, which have relatively low nutritional content. In terms of raising livestock, goats are only carried out freely with minimal control efforts. This kind of raising provides an opportunity for inbreeding which causes a decrease in the genetic quality of goats. The implementation of PPTTG activities in Dayow Village significantly changed the behaviour of the community in raising goats, which at first were traditional changed to a modern direction, and had an impact on economic improvement. The empowerment of Dayow Village community related to goat livestock business takes place through the process of technology transfer, such as 1) semi ranch or sedentary housing technology to increase productivity; 2) superovulation technology to improve reproduction; and 3) cross-breeding technology to improve genetic quality.

The application of appropriate technology carried out through this PPTTG activities is considered successful in driving the community away from traditional goat husbandry towards a more modern direction that has an impact on increasing the economic income of the community. This is not the first time the community empowerment in animal husbandry efforts through the application of appropriate technology has been successfully carried out by the Implementation Team. Previously, community empowerment has also been promoted in various animal husbandry businesses, carried out in several villages in North Sulawesi Province, such as:

- 1) broiler chicken in Bulude Selatan Village, Kabaruan Subdistrict, Talaud Islands Regency in 2015 [11];
- 2) laying hens in Musi Village, Kalongan Subdistrict, Talaud Islands Regency in 2016 [12];
- 3) pig in Bulude Village, Kabaruan Subdistrict, Kepulauan Talaud Regency in 2016 [13]; and
- 4) free-range chicken in Laikit Village, Dimembe Subdistrict, Minahasa Utara Regency in 2018 [14].

From various community empowerment activities in the field of animal husbandry, both through PPTTG activities that have been carried out, as well as those that have been done before, the selection of appropriate technology is one of the keys to the successful implementation of the activities. Besides, people from each village have their traditions in running a livestock business. With these conditions, an approach of andragogy learning with a strategy that is appropriate to the characteristics of the community from each village is needed so that the process of technology transfer from traditional to modern can take place properly.

4. Conclusions

Through PPTTG activities, in an effort to apply technology of reproductive and production of goat to improve the standard of living of the people in Dayow Village, various community empowerment efforts have been facilitated, such as 1) increasing human resources through the mastery of science and technology in goat farming; and 2) increasing knowledge and skills to process livestock waste in the form of feces, urine, and food waste into solid and liquid organic fertilizer. Goat farming with a touch of technology is also a source of new economic income for the community. This activity can increase regional potential and community participation.

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