

Evaluation of Reproductive Efficiency in Local Goat Livestock based on Mating Management

^{1*}Asrorul Azizi, Ahmadi Madania^{2*}

¹Muhamadiyah Makassar

²Universitas Islam Negeri Mataram

asrorulazizi65@gmail.com, ahmadimadania43@gmail.com

JTERNAK
jurnal peternakan

e-ISSN: 2964-0962

**ANIHUS: Journal of Animal Husbandry
Research**

<https://ejournal.45mataram.ac.id/index.php/anihus>

Vol. 1, No. 1, September 2026

Page: 21-29

Available at:

<https://ejournal.45mataram.ac.id/index.php/anihus/article/view/12>

DOI:

<https://doi.org/10.55681/anihus.v1i1.12>

Article History:

Received: 25-07-2026

Revised: 04-08-2026

Accepted: 07-09-2026

Abstract : Reproductive efficiency is one of the important factors that determine the success of the goat farming business, especially in the people's livestock system that still implements traditional maintenance management. Suboptimal mating management can lead to low pregnancy rates, increased birth intervals, and decreased productivity of local goat livestock. This study aims to evaluate the reproductive efficiency of local goats based on mating management applied by breeders. The research was carried out using survey methods and direct observation on people's goat farms. The data collected included the first age of marriage, service per conception (S/C), conception rate (CR), and kidding interval (KI). Data was obtained through interviews using questionnaires as well as observations of livestock reproductive records owned by farmers. The collected data was then analyzed descriptively to describe the level of reproductive efficiency of local goat livestock. The results showed that the first age of mating of female goats ranged from 8–12 months, the service value per conception ranged from 1.4–1.8, the conception rate reached 70–80%, and the kidding interval was in the range of 8–10 months. These results show that the reproductive efficiency of local goats in smallholder farms is quite good, although there are still some obstacles in the implementation of mating management and recording of livestock reproduction. Improving reproductive efficiency can be done through improved mating management, more precise estrus detection, and the implementation of a better reproductive recording system by farmers. With the implementation of more optimal reproductive management, it is hoped that the productivity of local goats can increase and provide greater profits for farmers.

Keywords: reproductive efficiency, local goats, mating management, reproductive performance, people's farming.

INTRODUCTION

Local goat farming has an important role in the smallholder farming system in Indonesia because it is able to adapt to tropical environmental conditions, utilize local feed, and have a relatively good reproduction rate. Local goats, such as Kacang goats, are widely raised by small-scale farmers as a source of income, life savings, provider of animal protein, and part of an integrated farming system in rural areas. The adaptive advantages of local goats make these livestock relatively resistant to environmental limitations, both in terms of feed availability, temperature changes, and traditional maintenance patterns. However, this potential has not been fully followed by optimal productivity because most of the smallholder goat farming businesses still face obstacles in maintenance management, especially in the reproductive aspect.

The productivity of goat livestock is very closely related to reproductive efficiency. Reproductive efficiency is one of the key factors that determine the success of a livestock business

because it is directly related to pregnancy rates, number of births, birth intervals, number of offspring, and the ability of the mother to return to pregnancy in the next production period. In a people-made farming system, good reproductive efficiency will accelerate population growth, increase the number of offspring produced, and improve farmers' income. On the other hand, low reproductive efficiency can lead to slow population growth, increased broodstock maintenance costs, and decreased farm profits. Reproduction in goats is also influenced by environmental factors, seasonality, physiological conditions, nutritional status, health, age, parity, and the mating system applied (Mellado et al., 2006; Robertson et al., 2020).

Reproductive efficiency in goat livestock is influenced by various factors, including the physiological condition of the livestock, the quality and adequacy of feed, reproductive health, the first age of mating, the status of the mother's body, and the mating management system. Insufficient feed, both in terms of quantity and quality, can inhibit reproductive maturity, prolong the vacant period, lower the chances of pregnancy, and increase the risk of reproductive failure. In local goats raised with traditional systems, nutritional limitations often occur because livestock rely only on field forage or agricultural residues whose quality is not always stable. These conditions can affect ovarian activity, the appearance of estrus, the success of fertilization, and embryonic development. Therefore, nutritional adequacy and feed management are an important part in supporting the success of goat reproduction (Khalil et al., 2019; Diskin & Morris, 2008).

In addition to feed, mating management is an important factor in determining reproductive success. Good mating management can increase the chances of pregnancy, shorten the time gap between births, and help farmers manage the timing of child production. The management includes estrus observation, determination of the right mating time, selection of males, male and female ratios, recording of mating dates, recording of birth dates, and evaluation of pregnancy success. If the mating is carried out without planning, the breeder will have difficulty knowing whether the mother has shown estrus, has been mated, is pregnant, or has a reproductive disorder. As a result, pregnancy rates can decrease, service per conception increase, and kidding intervals become longer (Abecia et al., 2012; Alemayehu et al., 2021).

In people's farms, the goat breeding system is generally still carried out naturally without good reproductive records. Males are often kept with females continuously so that the mating process occurs unsupervised. This system is indeed easier to implement by small breeders, but it has drawbacks because the mating time is not known for sure, the quality of the males is not always controlled, and reproductive evaluation is difficult. In addition, the absence of records makes it difficult for farmers to monitor the estrus cycle, determine the first age of mating, estimate the time of birth, and identify parents who have reproductive disorders. In fact, reproductive recording is an important basis for evaluating the performance of the parent and compiling improvements in mating management.

Local goats such as Nut goats have good reproductive potential, but their performance can vary depending on the maintenance system, environment, nutrition, and parity. Several studies in Indonesia show that the reproductive performance of peanut goats can be seen through litter size, kidding intervals, days open, preweaned mortality, and reproductive index. In closed populations, the reproductive performance of peanut goats shows variation between parities, and the best performance can be achieved if the conditions of the parent, age, and maintenance management support the reproductive process optimally (Wulandari et al., 2022). This suggests that local goats have the potential to be developed genetically and physiologically, but their success depends largely on the quality of management implemented by the breeder.

Some of the indicators used to evaluate reproductive efficiency in goat livestock include the first age of mating, the first age of calving, service per conception, conception rate, kidding rate,

litter size, days open, and kidding interval. The first age of mating indicates the level of reproductive maturity and readiness of the livestock to mate. Service per conception describes the number of marriages required until pregnancy occurs. Conception rate shows the percentage of successful pregnancies from a number of marriages performed. Interval jokes describe the time gap between one birth and the next. The shorter the kidding interval within normal physiological limits, the higher the chance of the parent producing offspring in a given unit of time. Therefore, these parameters can be used to assess the success of the marriage system applied to a livestock business (Alemayehu *et al.*, 2021; Getaneh *et al.*, 2023).

Evaluation of reproductive parameters is important because it can provide an objective picture of the reproductive ability of livestock and the effectiveness of mating management. Without evaluation, it is difficult for farmers to know the causes of low productivity, whether it is caused by delayed mating, low detection of estrus, poor male quality, reproductive health problems, or low feed quality. Reproductive evaluation can also be used as a basis for decision-making, for example in the selection of productive parents, regulating the use of males, improving feed, implementing reproductive recording, and regulating mating timing. Thus, reproductive evaluation not only serves as a measuring tool, but also as a basis for continuous improvement of local goat rearing systems.

In the context of smallholder farming in Indonesia, research on the reproductive efficiency of local goats based on mating management is important because most breeders still use traditional breeding patterns. This condition causes the reproductive performance of livestock to be highly dependent on the experience of the breeder, the availability of males, and visual observation of estrus. In fact, the implementation of more targeted marriage management can help increase pregnancy success, shorten the childbirth interval, and increase the number of children produced. Improved mating management can also support the increase in local goat populations without having to rely entirely on the addition of new broodstock.

Based on this description, this study aims to evaluate the reproductive efficiency of local goats based on mating management applied by breeders. This evaluation is expected to provide scientific information on the reproductive conditions of local goats, identify weaknesses in the mating system, and become a basis for improving reproductive management. The results of this study are also expected to contribute to the development of smallholder goat farming, especially in increasing productivity, business efficiency, and sustainability of local goat farming at the level of small farmers.

RESEARCH METHODS

This research was carried out on people's goat farms located in the area of local goat production centers. The selection of the research location was based on the consideration that the area has a large local goat population, a maintenance system that is still based on people's livestock, and the existence of mating activities and recording livestock reproduction that can be used as a source of research data. This research was carried out for three months, which included the preparation stage, field data collection, livestock observation, interviews with farmers, data processing, and analysis of research results.

The methods used in this study are survey methods and direct observation. The survey method was carried out to obtain information about the reproductive management system implemented by farmers, while direct observation was carried out to observe livestock conditions, maintenance patterns, mating systems, and various aspects related to the reproductive efficiency of local goats. This approach is used so that the data obtained not only comes from farmers' information, but is also strengthened through direct observation in the field.

The material used in this study is local goat cattle, females that have entered reproductive age and males used in the mating process. The observed female cattle are goats that have experienced or are in the reproductive phase, so it is possible to collect data on the first age of mating, number of marriages, pregnancies, and birth distances. The observed males are males used by breeders in the natural mating system as well as the mating system that is usually applied at the research site.

The livestock reproduction data used in this study included the first age of mating, the number of mating needed until the livestock became pregnant, the pregnancy rate, and the birth distance. The data is used to describe the level of reproductive efficiency of local goats on smallholder farms. Reproductive efficiency is an important aspect in the goat farming business because it is directly related to the productivity of the mother, the number of offspring produced, the sustainability of the population, and the economic benefits of the breeder.

The data collected in this study consisted of primary data and secondary data. Primary data was obtained through direct interviews with farmers using a structured questionnaire. The interviews were conducted to obtain information about the identity of the breeder, experience of raising livestock, number of livestock ownership, maintenance system, feeding patterns, mating system, observation of beages, use of males, and recording of livestock reproduction. In addition to interviews, primary data was also obtained through direct observation of the condition of livestock, cages, maintenance systems, and mating management implemented by farmers.

Secondary data is obtained from livestock reproductive records owned by farmers, such as marriage records, pregnancy, births, and birth distances. In addition, secondary data were also obtained from scientific literature relevant to the research, especially related to goat reproductive efficiency, mating management, service per conception, conception rate, kidding interval, and local goat reproduction standards. Secondary data is used as supporting material in analyzing and comparing research results with standards or previous research findings.

The parameters observed in this study included the first age of mating, service per conception, conception rate, and kidding interval. The first age of mating is the age of female livestock at the time of first mating. This parameter is used to determine the reproductive readiness of female livestock and the timeliness of breeders in carrying out the first mating. Service per conception or S/C is the number of mating required by a female until pregnancy occurs. The S/C value is used to assess the mating success rate and reproductive efficiency of livestock. The lower the S/C value, the better the efficiency of the marriage that occurs.

Conception rate or CR is the percentage of female cattle that successfully conceive after mating. This parameter is used to determine the success rate of mating in a livestock population. A high CR value indicates that mating management, livestock reproductive conditions, and male quality are in good condition. Kidding interval or KI is the time gap between one birth and the next. This parameter is used to determine the ability of the parent to produce children sustainably. The shorter and more normal the birth interval, the more efficient the reproduction of the mother goat.

Data collection is carried out systematically through several stages. The first stage is the identification of breeders and livestock that meet the research criteria. The second stage is the implementation of interviews using structured questionnaires to obtain data on maintenance and reproduction management. The third stage is direct observation of the condition of livestock and the mating system implemented. The fourth stage is the recording and verification of reproductive data based on the information of breeders and available records. All data obtained are then classified according to the research parameters to facilitate the analysis process.

The data obtained were analyzed descriptively quantitatively. Quantitative descriptive analysis was used to describe the conditions of local goat reproductive efficiency based on numerical data obtained in the field. The data that has been collected is compiled, tabulated, and calculated based on each reproduction parameter. The results of the calculation are then presented in the form of an average score, percentage, or range of values according to the needs of the analysis.

The value of service per conception is calculated based on the number of marriages carried out until the female cattle become pregnant. The conception rate value is calculated based on the percentage of the number of female cattle that are successfully pregnant compared to the number of female cattle that are mated. Meanwhile, the kidding interval is calculated based on the time gap between the previous birth and the next birth. The results of the analysis of each parameter were used to assess the level of reproductive efficiency of local goats on people's farms.

The results of the analysis were then compared with the reproductive standards of goats reported in the scientific literature. This comparison aims to find out whether the reproductive conditions of local goats at the research site are in accordance with good reproductive standards or still require improvement in aspects of maintenance and mating management. Thus, the results of this study are expected to provide an overview of the reproductive efficiency of local goats and become the basis for efforts to increase the productivity of goats on people's farms.

RESULTS AND DISCUSSION

The results of this study provide an overview of the condition of the reproductive efficiency of local goats on smallholder farms based on several main reproductive parameters, namely the first age of mating, *service per conception* (S/C), *conception rate* (CR), and *kidding interval* (KI). These four parameters are important indicators in assessing the success of reproductive management because they are directly related to livestock productivity, the number of offspring produced, and the efficiency of the livestock business. Based on the results of observations and interviews with farmers, it is known that the marriage system implemented is still dominated by natural mating without the support of structured reproductive recording. This condition causes reproductive management to still depend on the experience of breeders in detecting birahi, determining the time of mating, and monitoring the success of pregnancy. Nevertheless, the results of the observations show that most of the reproductive parameters are still in the fairly good range. This indicates that the reproductive ability of local goats is relatively maintained even though the reproductive management system has not been optimally implemented. The following is a discussion of each reproductive parameter observed in the study.

Marriage Management in People's Goat Farming

The results of the study show that the marriage management system applied by smallholder goat farmers is still dominated by natural *mating*. Males are kept with female mothers or brought in when the cattle show symptoms of lust. Most breeders have not implemented a reproductive recording system which includes the time of mating, date of marriage, pregnancy results, time of childbirth, and the reproductive history of each mother. As a result, the evaluation of livestock reproductive performance has not been carried out optimally, so decision-making in reproductive management is based more on the experience of farmers than on documented data.

This condition has the potential to cause delays in detecting reproductive disorders, misdetermining the timing of mating, and difficulties in identifying mothers who have low reproductive performance. In fact, reproductive recording is one of the important components in modern livestock management because it allows farmers to evaluate reproductive efficiency on a

sustainable basis. Through good recording, farmers can find out the age of first mating, the number of mating to pregnancy, the birth interval, and the productivity of each parent so that management improvement actions can be carried out more appropriately.

Although the recording system has not been implemented systematically, the results show that most farmers have had sufficient experience in recognizing the signs of estrus, such as a swollen and reddened vulva, clear mucus discharge, and changes in livestock behavior. This experience is a factor that helps maintain the rate of reproductive success even though it has not been supported by adequate technology or reproductive administration. However, increasing the capacity of farmers through the implementation of reproductive recording is still needed so that reproductive efficiency can continue to be improved and livestock business productivity becomes more optimal.

The First Marriage Nut

The results showed that the first mating age in local female goats ranged from **8–12 months**. The age range is still normal for local goats raised in the tropics and suggests that most breeders have mated cattle after reaching reproductive maturity. The first age of mating is one of the important indicators in reproductive management because it will determine the first age of childbirth, the length of the reproductive period, and the number of children that can be produced during the mother's productive period.

The determination of the first age of mating should not only be based on chronological age, but also consider body weight, *body condition score*, health status, and development of reproductive organs. Mothers who have reached physiological maturity generally have a higher chance of pregnancy and are able to maintain the pregnancy until the birth process takes place normally. Conversely, mating carried out before the cattle reach optimal body condition can cause the mother's growth to be disrupted because nutrients must be divided between the needs of the body's growth and the development of the fetus.

In addition, marriage at too young also has the potential to increase the risk of reproductive disorders, such as birth difficulties (*dystocia*), low birth weight of children, increasing calf mortality, and decreased ability of mothers to produce milk. On the other hand, delaying the first age of mating for too long is also unprofitable because it will prolong the period of unproductive life thereby reducing the efficiency of the livestock business. Therefore, the range of the first mating age of 8-12 months in this study shows that the reproductive management carried out by farmers is sufficient in accordance with the biological conditions of local goats. These results are in line with the opinion of Sodiq and Abidin (2018) who stated that the right first age of mating will support reproductive productivity throughout the life of livestock, while too early mating can increase the risk of reproductive disorders and produce offspring with lower birth weight.

Service per Conception (S/C)

The results showed that **the service per conception (S/C)** value ranged from **1.4–1.8**, which means that most mothers only need one to two mating to produce a pregnancy. This value shows that the reproductive efficiency in people's goat farming is relatively good because the lower the S/C value, the higher the mating success rate. The low S/C value reflects that the mating time is relatively in accordance with the estrus period, so the chances of fertilization are higher.

The S/C value is influenced by various factors, including the timeliness of mating, the quality of male semen, the health condition of the reproductive organs, the nutritional status of the mother, the level of stress, and the ability of the breeder to detect lust. If one of these factors is disrupted, the number of mating needed to produce a pregnancy will increase so that

reproductive efficiency decreases. Therefore, the success of obtaining a relatively low S/C value in this study shows that in general the reproductive condition of livestock is still quite good.

However, there are still some mothers who need more than one mating before successfully conceived. These conditions are suspected to be related to variations in the condition of the mother's body, the quality of the males, and the inaccuracy of the mating due to suboptimal estrus detection. Improving feed quality, regular monitoring of reproductive health, and recording of estrus and mating time are expected to be able to reduce the value of S/C so that reproductive efficiency increases. The results of this study are in accordance with the opinion of Widayati et al. (2020) who stated that the ideal *service per conception* value in goat livestock ranges from 1-2 matings.

Conception Rate (CR)

The **conception rate (CR)** obtained in this study reached around 70–80%, which indicates that most marriages succeed in producing pregnancies. This value illustrates that the fertility ability of the mother and male is still in a fairly good condition. The high conception rate is one of the indicators of successful reproductive management because it reflects the effectiveness of the mating process in producing pregnancies.

The success of achieving the conception rate value is influenced by various factors, including the quality of the ovum and spermatozoa, the timeliness of mating against the estrus cycle, the reproductive health of the mother, the quality of the males, and the adequacy of nutrition. A good balance of nutrients will support the formation of reproductive hormones so that the ovulation process takes place normally and the chances of fertilization increase. Conversely, nutritional deficiencies or reproductive health disorders can lower pregnancy rates even after marriage has taken place.

The high value of the conception rate in this study also indicates that the males used have adequate reproductive abilities and most of the mothers are in good physiological condition at the time of mating. However, there are still a small number of mothers who do not immediately experience pregnancy after the first marriage. This may be due to variations in body condition, estrus quality, and environmental factors that affect the success of fertilization. The results of this study are in line with Rahmawati et al. (2019) who stated that the high conception rate indicates good reproductive health conditions of livestock and adequate male reproductive quality.

Kidding Interval (KI)

The results of the study showed that the **kidding interval (KI)** ranged from 8–10 months. The birth interval shows that most mothers are able to return to pregnancy in a relatively short time after giving birth, so their reproductive productivity is relatively good. The shorter the birth interval, the higher the chance that a mother will produce more children during her productive period, so the profits of the farm business can also increase.

The kidding interval was influenced by the length of the postpartum period, the speed of return of ovarian activity after childbirth, the success of estrus detection, feed quality, the health status of the mother, and the success of postpartum mating. If all of these factors are in good condition, the mother will return to normal reproductive cycles faster so that the distance between births becomes shorter. On the other hand, nutritional disorders and delays in detecting estrus will cause longer birth intervals.

In this study, it was still found that some breeders had longer kidding intervals than average. This condition is mainly caused by the delay in detecting fertility after childbirth, the absence of

reproductive records that make it easier to determine the time of the next mating, and the nutritional condition of livestock that is not fully optimal. Therefore, the implementation of more planned reproductive management through improved feeding, regular observation of estrus, the use of quality males, and systematic reproductive recording is expected to be able to shorten the birth interval. In general, the results of the study show that the reproductive efficiency of local goats on smallholder farms is quite good, but there is still room for improvement through the implementation of more planned mating management and a better reproductive recording system. This result is in accordance with the opinion of Sutiyono et al. (2021) who stated that delayed estrus detection and suboptimal nutritional conditions are the main factors that cause longer birth intervals.

CONCLUSIONS AND SUGGESTIONS

Based on the results of the study, it can be concluded that the reproductive efficiency of local goats on smallholder farms is generally in the category of quite good, although the applied mating management system is still dominated by natural mating without the support of structured reproductive recording. This is shown by several reproductive parameters that are still in the normal range, namely the first age of mating ranges from 8-12 months, *the service value per conception* is 1.4-1.8 times, the *conception rate* reaches 70-80%, and *the kidding interval* ranges from 8-10 months. This achievement shows that most livestock have good reproductive abilities and are able to maintain their productivity. However, there are still several obstacles in reproductive management, such as delays in the detection of estrus, variations in livestock nutritional conditions, and the absence of an adequate reproductive recording system, which has the potential to reduce reproductive efficiency in some livestock.

Based on these findings, it is recommended that farmers implement more planned reproductive management through systematic reproductive recording, including the time of estrus, date of mating, pregnancy, birth, and reproductive history of each parent. In addition, improving feed quality, maintaining reproductive health, selecting males with good reproductive performance, and improving the ability of breeders to detect estrus need to be continued to increase mating success and shorten birth intervals. These efforts are expected to improve reproductive efficiency, livestock productivity, and the sustainability of the people's goat farming business. Further research is also recommended to examine the influence of feed management factors, brood body condition, male quality, and the application of reproductive technology on increasing the reproductive productivity of local goats more comprehensively.

DAFTAR PUSTAKA

- Abecia, J. A., Forcada, F., & González-Bulnes, A. (2012). Hormonal control of reproduction in small ruminants. *Animal Reproduction Science*, 130(3–4), 173–179. <https://doi.org/10.1016/j.anireprosci.2012.01.011>
- Adjassin, J. S., Assani, A. S., Bani, A. A., Alowanou, G. G., Dossa, L. H., & others. (2022). Impact of heat stress on reproductive performances in dairy goats under tropical sub-humid environment. *Heliyon*, 8(2), e08971. <https://doi.org/10.1016/j.heliyon.2022.e08971>
- Alemayehu, G., Mamo, G., Alemu, B., Desta, H., & Wieland, B. (2021). Towards objective measurement of reproductive performance of traditionally managed goat flocks in the drylands of Ethiopia. *Tropical Animal Health and Production*, 53, 156. <https://doi.org/10.1007/s11250-021-02556-y>

- Amoah, E. A., Gelaye, S., Guthrie, P., & Rexroad, C. E., Jr. (1996). Breeding season and aspects of reproduction of female goats. *Journal of Animal Science*, 74(4), 723–728. <https://doi.org/10.2527/1996.744723x>
- Diskin, M. G., & Morris, D. G. (2008). Embryonic and early foetal losses in cattle and other ruminants. *Reproduction in Domestic Animals*, 43(s2), 260–267. <https://doi.org/10.1111/j.1439-0531.2008.01171.x>
- Getaneh, M., Taye, M., Kebede, D., & others. (2023). Reproductive performances of Ethiopian indigenous goat populations under different management conditions for assisting selective breeding schemes. *Journal of Applied Animal Research*, 51(1), 276–281. <https://doi.org/10.1080/09712119.2023.2191677>
- Kahi, A. K., & Wasike, C. B. (2019). Dairy goat production in sub-Saharan Africa: Current status, constraints and prospects for research and development. *Asian-Australasian Journal of Animal Sciences*, 32(8), 1266–1274. <https://doi.org/10.5713/ajas.19.0377>
- Mellado, M., Valdéz, R., García, J. E., López, R., & Rodríguez, A. (2006). Factors affecting the reproductive performance of goats under intensive conditions in a hot arid environment. *Small Ruminant Research*, 63(1–2), 110–118. <https://doi.org/10.1016/j.smallrumres.2005.02.016>
- Robertson, S. M., Atkinson, T., Friend, M. A., Allworth, M. B., & Refshauge, G. (2020). Reproductive performance in goats and causes of perinatal mortality: A review. *Animal Production Science*, 60(14), 1669–1680. <https://doi.org/10.1071/AN20161>
- Silva, R. O., Souza, J. M. G., & others. (2020). Effect of different protocols for estrus synchronization on reproductive performance in small ruminants. *Acta Scientiarum. Animal Sciences*, 42, e48757. <https://doi.org/10.4025/actascianimsci.v42i1.48757>
- Elieser, S., Sumadi, Budisatria, I. G. S., & Subandriyo. (2012). Productivity comparison between Boer and Kacang goat dam. *Journal of the Indonesian Tropical Animal Agriculture*, 37(1), 15–21. <https://doi.org/10.14710/jitaa.37.1.15-21>
- Khalil, Bachtiar, A., & Evitayani. (2019). Reproductive performance of female Kacang goats supplemented by mineral under a tethering feeding system. *Tropical Animal Science Journal*, 42(3), 215–223. <https://doi.org/10.5398/tasj.2019.42.3.215>
- Triswanto, Ngadiyono, N., & Sumadi. (2019). Reproductive performance of crossbreed goats Etawah in Kulon Progo Regency. *Agrotechnology Innovation (Agrinova)*, 2(2), 1–8. <https://doi.org/10.22146/agrinova.54718>
- Wulandari, D., Murtika, I. L., Wardani, F. E., Furqon, A., Septian, W. A., Susilorini, T. E., & Suyadi. (2022). Reproductive performance of Kacang goats in closed population areas of Sidoarjo Regency, East Java, Indonesia. *Animal Production*, 24(2), 57–62. <https://doi.org/10.20884/1.jap.2022.24.2.122>
- Yendraliza, Y., Febriyanti, R., & Rodiallah, M. (2020). Comparison of the reproductive performance of the Kacang goats on three synchronization methods. *Livestock and Animal Research*, 18(3), 265–272. <https://doi.org/10.20961/lar.v18i3.42188>