International Journal of Life Science and Agriculture Research
ISSN (Print): 2833-2091, ISSN (Online): 2833-2105
Volume 05 Issue 06 June 2026
DOI: https://doi.org/10.55677/ijlsar/V05I06Y2026-11
Impact Factor: 7.88, Page No: 520-527

The Effect of Organic Tablet Supplementation Based on Sesbania Grandiflora Leaves on The Quality of Post-Thaw Kacang Buck Semen

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ABSTRACT

This study aims to determine the effect of administering organic tablets based on Sesbania grandiflora leaves on the motility and viability of Kacang buck spermatozoa post-thawing. A completely randomized design with five replications was applied, consisting of two treatments: bucks offered a native grass basal diet (T0) and native grass supplemented with organic tablets based on Sesbania grandiflora leaves (T1). The extender used was tris egg yolk with the addition of 6% glycerol during equilibration. Fresh semen was collected from 10 Kacang bucks, with 5 assigned to T0 and 5 to T1, all aged 2 years with an average body weight of 25 kg. Data were analyzed using ANOVA followed by Duncan's multiple range test. The results showed that all macroscopic indicators of fresh semen were relatively better in T1 compared to T0. Likewise, the quality of spermatozoa post-thawing in T1 was superior to that in T0. In conclusion, administering Sesbania grandiflora leaf-based organic tablets improves the motility and viability of Kacang buck spermatozoa post-thawing.

KEYWORDS: Tablet, Sesbania grandiflora, semen, spermatozoa, Kacang buck

Published online: June 22, 2026

***Cite the Article:** Liana, E., Zaenuri, L.A. (2026). The Effect of Organic Tablet Supplementation Based on Sesbania Grandiflora Leaves on The Quality of Post-Thaw Kacang Buck Semen. International Journal of Life Science and Agriculture Research, 5(6), 520-527.*
https://doi.org/10.55677/ijlsar/V05I06Y2026-11

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1. INTRODUCTION

One of the key factors supporting livestock productivity is feed. Feed provides various essential nutrients for livestock, including energy, fat, protein, minerals, and vitamins (Tilman et al., 1998). Ruminant feed typically consists of green fodder such as grasses and legumes. During the rainy season, green fodder is abundant; however, it becomes scarce during the dry season, often leading to weight loss. The nutrients in feed are utilized by livestock for maintenance and to support productivity. Adequate protein intake is crucial; if the protein content in feed falls below 2%, feed consumption decreases, resulting in weight loss, weakened body condition, reduced libido, and decreased semen production (Dethan et al., 2010). Frandson (1992) noted that protein deficiency can delay puberty and impair testicular function in adult males, leading to poor semen quantity and quality. To address the limited feed supply during the dry season, one effective strategy is to utilize leguminous plants, such as the leaves of Sesbania grandiflora.

The abundant production of Sesbania grandiflora during the rainy season can be preserved by converting it into organic tablets, which can be used during the dry season. However, excessive use of Sesbania grandiflora leaves is detrimental due to their high content of anti-nutrients (phenolic compounds), high buffering capacity, and the risk of poisoning in livestock (Sidiq, 2014).

The practice of feeding Sesbania grandiflora leaves to livestock typically involves offering them fresh, including the stems and leaf stalks. This method is inefficient, leading to significant feed wastage. Providing Sesbania grandiflora leaves in organic tablet form is more practical, as it delivers a complete feed that is fully consumed, reduces costs and energy expenditure, and facilitates better control of the livestock's nutritional intake. The high protein and energy content of Sesbania grandiflora leaves contribute to their use as a primary ingredient for improving the semen quality of Kacang bucks. Therefore, research is needed to evaluate the effects of using Sesbania grandiflora leaves, packaged as organic tablets based on turi leaves, on the motility and viability of Kacang buck spermatozoa after thawing.

II. MATERIALS AND METHODS

Research Materials

The material used in this study consisted of semen collected from five 3-year-old Kacang bucks, each with an average body weight of 25 kg. Semen evaluation was conducted at the Animal Reproduction Laboratory, Faculty of Animal Husbandry, University of Mataram. The Kacang bucks were sourced from local livestock markets and varied in origin, care, and feeding practices. Therefore, it was essential to ensure that the bucks were healthy and free from internal and external parasites before commencing the research. To eliminate internal parasites, the bucks were treated with Warmnzol (Medion, Bandung, Indonesia) at a dose of 7.5 g per head per week for four weeks. To prevent external parasites, particularly scabies, Warmectin (Medion, Bandung, Indonesia) was administered via subcutaneous injection twice, with a seven-day interval between doses.

Organic Tablet Formulation

The organic tablet formulation was made according to the description by Zaenuri and Irwansyah (2026) as follows:

Table 1. Organic formulation of tablets

Ingredients	Kuantities (%)	Offered (gr/head)
Sesbania grandiflora leaf powder	36	45
Rice brand	22	28
Molasis	27	35
Lime	7	9
Salt	6	8
Mineral mix	2	3
Total	100	128

Research Variables

The primary variables included fresh semen quality, post-thaw sperm motility, and viability. Supporting variables comprised fresh semen quality, proximate analysis of Sesbania grandiflora leaf tablets, and blood analysis of Kacang bucks.

Research Design and Methods

The study was conducted using a completely randomized design with two treatments and five replications. The research method was a laboratory experiment. The data analyzed included macroscopic semen characteristics such as volume, color, odor, consistency, and pH of fresh semen. Additionally, macroscopic fresh semen parameters included mass motility, individual motility, viability, and sperm concentration. Post-thaw sperm quality data comprised sperm motility and viability. Semen and spermatozoa evaluations were performed using the methods described by Zaenuri et al. (2023, 2024, and 2025).

Data Analysis

Data were analyzed using one-way repeated measures analysis of variance, with the non-supplemented method included as a covariate. The collected data were tabulated and further analyzed using paired t-tests with SPSS version 16. A p-value of less than 0.05 was considered statistically significant. Data are presented as means ± standard errors.

III. RESULTS AND DISCUSSION

Fresh Semen Evaluation

The quality of semen produced by males can be determined by observing it both macroscopically and microscopically. Semen examination should be performed shortly after collection; however, the observation process must be conducted quickly, thoroughly, and carefully to prevent the death of many spermatozoa (Zenichiro et al., 2002). In this study, semen was collected five times for both T0 and T1 groups at four-day intervals. The results of the macroscopic and microscopic evaluations of fresh semen are presented in Table 2.

Table 2. Mean and standard deviation of fresh semen evaluation results before and after administration of organic tablets

Parameter	Treatments	
	T0	T1
Colour	creem	creem
Aromatic	specific	specific
Volume (ml)	0,68±0,15[a]	0,88±0,04[a]
Concistensi	Medium	Medium
pH	6,85±0,05[a]	6,86±0,10[a]
Mass motility (%)	++	+++

Sperm Individual motility (%)	82,25±0,85[a]	93,00±0,40[b]
Sperm concentration (× 10^6)	1.330,25±35,56[a]	3.026,50±17,57[b]
Viability (%)	81,75±1,03[a]	93,75±0,62[b]

Note: Different superscripts in the same row indicate significant differences (P<0.05)

Macroscopic observation refers to the evaluation of semen quality using the naked eye. Herdiawan (2004) stated that macroscopic semen quality can be assessed by examining color and odor, volume, consistency, and pH. The results of the macroscopic and microscopic semen examinations in this study are as follows:

Semen Color and Odor

The fresh semen from Kacang bucks in this study was creamy, likely due to the relatively high sperm concentration. Goat semen appears white and creamy when the sperm concentration is high (Evans and Maxwell, 1987). Typically, goat semen ranges from milky white to creamy (Ax et al., 2000; Tambing et al., 2001; Suyadi et al., 2012; Salmah, 2014), which indicates good-quality semen, as it is free from foreign matter. Conversely, semen with a high riboflavin content tends to be yellowish (Evans and Maxwell, 1987). Reddish to brownish semen usually indicates an infection in the male reproductive tract (Herdis and Rizal, 2008).

Semen color is often associated with its odor. Semen has a characteristic odor; a fishy smell may indicate the presence of blood caused by a genital tract infection (Zaenuri et al., 2023). A distinctive, non-pungent odor aligns with the findings of Arifiantini (2012) and Apriyanti (2012), who reported that a pungent odor is related to bacterial content in semen. A distinctive odor typically indicates that the semen is normal and free from microbial contamination (Suyadi et al., 2012). In this study, the semen generally exhibited a cream color and a distinctive odor both before and after the administration of organic Sesbania grandiflora leaf-based tablets.

Semen Volume

Semen volume can be directly measured using the milliliter scale on the collection tube. Table 2 shows that the statistical analysis revealed no significant increase ($P \geq 0.05$) in semen volume before and after administration of the organic tablets, with values of 0.68 ± 0.15 ml and 0.88 ± 0.04 ml, respectively. This insignificant increase may be attributed to the suboptimal dosage of the supplement administered. However, the semen volume observed in this study remains within the normal range reported for goats: 0.1–1.5 ml (Evans and Maxwell, 1987), 0.5–1.5 ml (Retzlaff, 1995), and 0.45–1.15 ml (Gangyi et al., 2001). Semen volume varies according to breed, age, body size, nutrition, frequency of collection, and other factors that can influence goat semen volume (Evans and Maxwell, 1987; Ax et al., 2000).

Semen Viscosity and Sperm Concentration

Viscosity is assessed by gently tilting the semen tube and then returning it to its original position to determine whether the fluid is thin, medium, or thick. Mahmilia et al. (2006) and Pamungkas et al. (2006) reported that the consistency of fresh goat semen ranges from thick to thin. In this study, the consistency of Kacang buck semen was medium—neither thin nor thick—in both T0 and T1.

Assessment of spermatozoa concentration is crucial as it serves as a criterion for evaluating semen quality and determining the appropriate level of extender to use. Normal spermatozoa concentration corresponds to a semen plasma content of approximately 80% of the total semen volume, whereas semen with a low sperm count typically has a plasma content of about 90% (Salisbury and Vandenmark, 1985). In this study, spermatozoa concentration showed a significant difference ($P < 0.05$) between T0 and T1, with values of 1,330.25 ± 35.56 × 10^6/ml and 3,026.5 ± 17.57 × 10^6/ml, respectively. The increase in spermatozoa concentration in T1 is likely due to the fulfillment of the livestock's nutritional requirements. Ax et al. (2000) reported that spermatozoa concentration is influenced by factors such as diet, breed, age, environment, and ejaculation frequency. The spermatozoa concentrations observed in this study are consistent with those reported by previous researchers, which ranged from 1,000–1,500 × 10^6 cells/ml (Cole and Cupps, 1997), 2,500–5,000 × 10^6 cells/ml (Maxwell, 1987), and 2,801–3,530 × 10^6 cells/ml (Tambing et al., 2000). Therefore, the goat sperm concentrations obtained in this study are considered normal and suitable for further processing.

Semen Acidity (pH)

Semen acidity (pH) significantly affects sperm viability and quality (Zaenuri et al., 2026). Both high and low acidity levels cause a rapid decline in sperm viability. Goat sperm pH generally ranges between 6.0 and 6.7 (Varshaey et al., 1977) and 6.52 to 6.67 (Singh and Purbey, 1994). The normal pH of goat semen is approximately 7.0 (Zaenuri et al., 2025). Semen pH is influenced by sperm concentration; higher sperm concentrations result in lower semen pH. This occurs because increased spermatozoa produce more lactic acid, making the semen more acidic (Herdis and Rizal, 1993). The average semen pH in T0 was 6.85 ± 0.05, which did not differ significantly from T1 at 6.86 ± 0.10. The semen pH of goats and sheep is considered appropriate within the range of 6.5 to 6.8 (Hafez, 1987). Similarly, Sekosi et al. (2016), Drajat (2002), and Sarwono (1999) reported that semen pH generally ranges from 6.4 to 7.0. Therefore, the goat semen pH results in this study are within the normal range.

Sperm Motility

Motility, the movement of spermatozoa, is a straightforward and essential benchmark for assessing sperm quality in artificial insemination, as it serves as an early indicator of male fertility and can be evaluated in vitro (Zaenuri et al., 2025). Motility is classified into three categories: mass motility, individual motility, and progressive motility. In species with in vivo fertilization, motility is critical for sperm transport within the reproductive tract to reach and fertilize the egg (Holt and Van Look, 2004).

The semen mass motility of Kacang bucks in this study increased from ++ to +++ in T1 (Table 2). These mass motility results align with those reported by Hastono et al. (2013) and Hidayati (2017), who described the semen mass motility of Sapera goats (+++) as rapid, dark, thick, and exhibiting active movement. The mass motility observed in this study is higher than that reported by Hikmawan et al. (2016) for Ettawah goats, which was rated as ++. Meanwhile, the percentage of individual sperm motility in this study averaged 82.25 ± 0.85% in T0 and increased significantly ($P < 0.05$) to 93.00 ± 0.40% in T1. This individual sperm motility is consistent with findings by Suwarso (1999) and Soeparno (1984), who reported goat sperm motility ranging from 75% to 90%. The percentage of live spermatozoa in Ettawah goats can reach 94%, and in Kacang bucks, around 95%. Two previous studies (Zenichiro et al., 2002; Kusumawati and Leondro, 2015) stated that fresh semen must have motility greater than 70% to be suitable for processing into frozen semen for artificial insemination. The results of this study exceed those reported by Kusumawati et al. (2017), who found 75.2%, and Pamungkas et al. (2008), who reported 88.57 ± 7.85%.

The increase in mass and individual motility of spermatozoa in T1 is attributed to the fulfillment of the livestock's nutritional requirements, both in quality and quantity. Individual motility in this study was

considered normal in both T0 and T1. The motility percentage observed here is higher than that reported by Kaka (2010), who documented an average individual motility of 76.67% in fresh goat semen. Similarly, Syawal et al. (2015) reported individual motility percentages of 78% and 79% in sperm from goats supplemented with Sauropus androgynus L. leaf meal. These findings suggest that supplementing Kacang bucks with organic tablets based on Sesbania grandiflora leaves positively impacts semen production and quality. As noted by Cameron et al. (1998), livestock fed nutrient-rich diets exhibit increased semen production. Moreover, it is hypothesized that Sesbania grandiflora leaves, combined with other ingredients, enhance the supplement's quality, thereby benefiting livestock by meeting their nutritional needs and improving both the quantity and quality of semen, especially when evaluating fresh semen for further analysis or processing (Zaenuri et al., 2023). Below is the nutritional content analysis of the Sesbania grandiflora leaf-based organic tablet supplement.

Table 3. Proximate analysis of the organic tablet from this study based on Sesbamia grandiflora leaves using the AOAC method

Note	Composition (%)				
	Water	Ash	Crude fat	Crude fiber	Crude protein
Feed nutrien	19,70	15,79	0,34	7,52	6,54

Spermatozoa viability

The percentage of spermatozoa viability before and after feeding with organic Sesbania grandiflora leaf-based tablets increased significantly ($P \leq 0.05$), from 81.75 ± 1% to 93.75 ± 0.62%. The sperm viability observed in this study was higher than that reported by Kaka (2010) in Etawah crossbred goats and Inonie et al. (2016) in Kacang bucks, which were 81.45% and 93.43 ± 1.20%, respectively. These results indicate that feed quality can affect spermatozoa viability. Specifically, the percentage of spermatozoa viability in Kacang bucks increased significantly ($P < 0.05$) from 81.75 ± 1.03 in the control group (T0) to 93.75 ± 0.62 in the treatment group (T1) (Table 2). The viability of Kacang buck spermatozoa remains within the normal range and is suitable for processing into frozen semen. This aligns with the findings of Kusumawati et al. (2016), who stated that goat spermatozoa viability of 90% or higher is ideal for frozen semen processing.

Sperm Motility and Viability Post-Thawing

The percentages of sperm motility before equilibration, after equilibration, and post-thawing in T0 and T1 are shown in Table 4.

Table 4. Individual motility of Kacang buck spermatozoa before equilibration, equilibration and post thawing at T0 and T1.

Assessment time	Spermatozoa individual motility (%)	
	T0	T1
before equilibration	71,50±2,72^{a}	84,25±1,31^{a}
During quilibration	55,75±4,80^{a}	73,50±1,44^{b}
Post Thawing	43,25±1,18^{a}	45,25±2,05^{a}

Note: Different superscripts in the same row indicate significant differences ($P<0.05$)

The data in Table 4 show no significant difference in sperm motility between pre-equilibration and post-thawing stages in T0 and T1. However, to better assess quality degradation at each stage, this study examined sperm motility at pre-equilibration, post-equilibration, and post-thawing stages both before and after supplementation.

The percentage of post-thaw sperm motility in bucks from the T0 group was recorded at 71.50 ± 2.72% before thawing, then decreased by 39.5% to 43.25 ± 1.18% after thawing (Table 4). Meanwhile, the percentage of individual sperm motility in bucks from the T1 group was 84.25 ± 1.31% before equilibration, then decreased by 46.29% to 45.25 ± 2.05% after thawing. This decrease is relatively normal, as the average reduction in individual sperm motility post-thaw ranges from 10% to 40% (Parrish, 2003) and can reach up to 50% (Sorenson, 1979). The ideal decrease in sperm motility percentage in sheep semen freezing is reported as 27.42% (Herdis, 2005), 27.16% (Suwarso, 1999), and 33.05% (Tambing, 2004). Therefore, feed supplementation using Sesbania grandiflora leaf-based tablets has a positive impact on sperm motility post-thaw. Additionally, according to the Indonesian National Standard (SNI, 2024), a minimum of 40% individual motility post-thaw is required, indicating that the semen remains highly suitable for use in artificial insemination programs.

Sperm viability in male Kacang bucks at T0 was lower compared to T1 (Table 5). This indicates that feed quality is a crucial factor in obtaining high-quality spermatozoa, as a balanced diet not only enhances productivity but also improves reproductive performance, which is reflected in semen quality. As explained by Frandson (1992), nutritional deficiencies can delay puberty and impair testicular function in male livestock. Livestock require adequate nutrients, particularly protein; if protein content in the ration falls below 2%, it can lead to reduced feed intake, weight loss, weakness, decreased libido, and lower sperm production (Zaenuri et al., 2023). Cameron et al. (1988) reported that livestock fed diets rich in nutrients, especially protein and energy, exhibit increased sperm production. In this study, proximate analysis using the AOAC (1990) method revealed the following composition: moisture content approximately 19.70%, ash 15.79%, crude fat 0.34%, crude fiber 7.52%, and crude protein 6.54% (Table 2).

Table 5. Average percentage of spermatozoa viability of Kacang buck at T0 and T1

Time of evaluatiom	Spermatozoa viability (%)	
	T0	T1
Pre-equilibration	74,25±5,12[a]	87,25±0,62[b]
Equilibration	69,00±1,63[a]	80,50±0,57[a]
Post Thawing	67,00±3,93[a]	75,50±3,87[b]

Note: Different superscripts in the same row indicate significant differences ($P<0.05$)

Blood analysis was conducted at both T0 and T1. The results indicated that blood glucose, total protein, and urea levels were higher at T1 compared to T0, with the exception of cholesterol levels (Table 5). Linder (1985) explained that body fat is metabolized into acetyl coenzyme A, which subsequently forms triglycerides. Widhyari et al. (2011) and Yupardhi (2004) further noted that triglycerides serve as a highly efficient source of calories for various energy-demanding processes in the body. Adequate, non-excessive levels of triglycerides, aligned with the body's needs, function as an energy source; one gram of fat yields 9 kcal. This energy is vital for living organisms, both at rest and during various livestock production activities. However, excessive energy expenditure without sufficient intake can cause energy imbalances, adversely affecting livestock production. Low intake and reduced rumination contribute to these imbalances, disrupting metabolism and ultimately impairing production.

Table 6. Results of blood analysis of Kacang buck at T0 and T1

Indicators	T0	T1
Blood Glukose	47,75	56,25
Total protein	5,7	6,05
Cholesterol	46,5	43,75
Ureum	19,75	20,75

Source: Results of blood analysis using the Enzymatic colorimetric method

In general, organic tablet supplementation based on Sesbania grandiflora leaves has a positive impact on the production and quality of semen in Kacang bucks. The improved semen quality is attributed to the nutritional content of Sesbania grandiflora leaves, which enhances the nutritional value of the basal feed. This finding is supported by proximate analysis, which showed that organic tablets derived from Sesbania grandiflora leaves can improve the quality of basal feed, such as field grass. Furthermore, blood analysis demonstrated that several tested parameters indicate an improvement in the nutritional value of the feed (Table 6).

IV. CONCLUSION

Administering Sesbania grandiflora leaf-based organic tablet supplements to male Kacang goats had a positive effect on both fresh and post-thawed semen quality.

V. ACKNOWLEDGMENTS

We would like to express our gratitude to the Rector of Mataram University for funding this research through Joint Student Research Grant Program.

VI. DISCLOSURE

The author reports no conflicts of interest in this work.

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