



Responses of Timor Deer (*Cervus timorensis* de Blainville 1822) to Silage Feeds for Animal Development and Conservation of Wild Life Animals In Captive Breeding Area

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Abstract - A research has been conducted to analyze the quality of silage feed, determine the eating behavior of Timor deer, Evaluation of the level of consumption and palatability of silage feed of a captive breeding area for Timor deer (*Cervus timorensis*) at Wosu Village, Bungku Barat District, Morowali District, Central Sulawesi Province from June to August, 2022. Three of Timor deer were used in this study with a body weight range of 25-50 kg. The study starting with the making of silage feed by using rice straw silage, maize straw silage and oil palm leaf silage. The Making of silage using brown sugar and 3% rice bran, with the ensilage process lasting for 21 days. Silage feed quality were determined based on physical and chemical characteristics (nutrient content). The response of the adaptation behavior of the Timor deer is gradual, so technically the observation have done by giving silage feed which is given gradually in the morning and evening before fresh forage is served. Feeding behavior was analyzed descriptively based on observations during the preliminary stage and data collection. Measurement of daily consumption with silage feed palatability index was carried out by feeding experiments consisting of P1: 30% rice straw silage and 70% elephant grass, P2: 40% maize straw silage and 60% elephant grass; P3: 50% palm leaf silage and 50% elephant grass. Analysis of the

palatability of Timor deer to alternative feed (silage) using Manly's Alpha (Manly 1972; Chesson 1978). Feed consumption was measured every day to determine the average daily consumption of Timor deer including consumption of fresh elephant grass and consumption of silage feed. The results showed that the quality of silage feed is the good category based on physical and chemical characteristics. Timor deer in captive provide a positive and adaptive feeding behavior response to silage feed. Palatability index analysis showed that Timor deer tended to like more maize straw silage and oil palm leaf silage compared with the rice straw silage feed. **Keywords** - Timor deer (*Cervus timorensis*), silage, elephant grass, rice straw, maize straw, oil palm leaf, captive breeding

I. INTRODUCTION

Timor deer (*Cervus timorensis*) is a wildlife animal that is endemic to Indonesia. The current population of the animal in its native habitat in Indonesia is probably declining due to many factors such as habitat loss, habitat degradation and poaching. To prevent a further decline in population, Timor deer has been included as a protected wildlife according to the Indonesian Government Regulation No. 7, 1999. Deer keeping and breeding in captive areas

an effort made to preserve the animals is expected to contribute to prevent a further reduction in deer population. The regulation allows the first deer offsprings (F1) resulted from the captive breeding to be transferred to other breeder as parents, while the second offsprings (F2) may be traded commercially.

Timor deer is one of the biodiversity of the Indonesian people, whose condition in nature is under great pressure as a result of human activities, both in the form of illegal hunting and habitat destruction. Timor deer are wild animals with very high adaptability, easy reproduction and easy feeding. In a captive deer breeding area, the availability of feed and the quality of extractable nutrients from the feed are among the important factors determining the life and performance of Timor deer. Since Timor deer is a ruminant species, the animal will depend primarily on the forage available in the grazing field of the captivity area (Arifuddin *et al.*, 2014). One of the factors determining the success of production in captive is feed. Feed is a limiting factor for ensuring the survival and breeding of animals, and also in terms of production costs according to Surung & Rahman (2012) reaching 70-80%. Therefore, to achieve high production, the amount and composition of the feed given needs attention so that it is technically biological to meet the needs of animals and is technically cheaper (efficient). Timor deer as ruminants, almost 90% of their basic needs come from forage as the main energy source (Hasan 2012).

In general, one of the problems faced related to forage for Timor deer in captive is the limited continuity of its availability because it is very dependent on the season. In the dry season the availability of feed decreases while in the rainy season it is abundant. Therefore, it is necessary to develop alternative feeds through the application of forage preservation techniques and optimizing the use of local feed ingredients in the form of agricultural waste and forage around the Timor deer captive location with a fairly large potential availability. The waste can also be developed through silage technique to be used as an alternative feed for Timor deer, namely rice straw, maize straw and oil palm leaves. Through the silage technique, it has been proven that feed ingredients from agricultural wastes of low quality (high crude fiber content and low protein) can actually be increased and have a positive effect as an alternative feed for ruminant animals (Hernaman *et al.* 2005). Based on the above, this study was conducted with the aim of analyzing the quality of

feed silage made, knowing the response of the eating behavior of Timor deer to the introduction of silage feed, knowing the eating behavior of Timor deer, evaluating the palatability index and consumption of Timor deer in the captive.

II. MATERIAL AND METHODS

Study Site and Procedures

This reasearch was carried out from July until August, 2022 at the captive breeding area of Timor deer (*Cervus timorensis*) in Wosu Village, West Bungku Subdistrict, Morowali, Central Sulawesi. The treatment feed consisted of fresh elephant grass, rice straw silage, maize straw silage and oil palm leaf silage with the composition of the three types of treatment feed in dry matter as Table 1. Each unit of Timor deer) was given fresh elephant grass and 10% silage feed and 5% fresh ingredients per kg body weight. Each treatment was given to three individuals of Timor deer as replication, consisting of 3 individuals of East Timor deer and 6 individuals of East Timor deer with a body weight range of 30-40 kg. Each Timor deer is placed in an individual cage measuring 2 x 2 m which is equipped with a place to eat and drink as needed.

Table 1. Feed composition of treatments

Feed composition	Treatment		
	R1	R2	R3
Elephant grass (%)	70	60	50
Rice straw silage (%)	30		
Maize straw silage (%)		4	
Oil palm leaf silage (%)		0	50

The study starting with the making of silage feed in the form of rice straw silage, maize straw silage and oil palm leaf silage. Rice straw, maize straw, and oil palm leaves were cut into pieces of 3-5 cm. Furthermore, each ingredient is mixed with 3% molasses until homogeneous, then put into a silo (plastic bag), compacted and tightly closed. The ensilage process lasts 21 days. Before being given to deer, silage is aerated or dried first. Before being given treatment, the Timor deer were first adapted to the cage environment for 7 days.

The treatment stages began with preliminary treatment for 10 days, followed by treatment to determine palatability for 14 days. After that, the preliminary treatment was carried out again for 10 days and continued with feeding treatment for 24

days. Feeding silage is done 2 hours before giving fresh elephant grass and given 2 times a day (morning and afternoon). Drinking water is provided ad libitum. To determine the effect of the treatment, a variance analysis was carried out. The quality of silage feed is determined based on physical characteristics (including smell, taste, color, texture and acidity) and chemical (nutrient content). The criteria for assessing the status of the physical quality of silage (Table 2) refer to Bolsen & Sapienza (1993), Bolsen et al. (2000) and Syarifuddin (2008). The chemical characteristics of the silage were determined based on the comparison of the results of the proximate analysis of silage and silage making materials, especially differences in the content of crude protein and crude fiber. Observation of feeding behavior was carried out to determine the response of the Timor deer to the introduction of silage feed. Feeding behavior was analyzed descriptively based on observations during the preliminary stage and data collection.

Analysis of the palatability of Timor deer to alternative feed (silage) using Manly's Alpha (Manly 1972; Chesson 1978). The value of the palatability index (α_i) obtained indicates the level of preference. If the value of the palatability index (α_i) $> 1/m$ means that the type of treatment feed is favored and if $i < 1/m$ it means that the type of treatment feed is not preferred, with the formula: $i = \frac{1}{m} \frac{\sum (r_{ij})}{\sum (n_j)}$, where: i = feed palatability index; n_i , n_j = the proportion of silage feed given; r_i , r_j = proportion of silage feed consumed; m = number of types of silage feed. Proximate analysis of feed study was carried out at the Animal Feed and Nutrition Laboratory, Faculty of Animal Science, UNTAD.

Table 2. Silage scoring criteria

Criteria	Very well	Good	Not bad	Bad
Smell	Acid	Acid	Not acid	Rotten
plavor	acidity	acid	acid	Not acid
Colour	dark green light brown*	war green light brown *	war green dark brown*	not green black*
Fungi and lenders	nothing	little	more	much
Texture	weak / not stiff congested*	weak / not stiff congested*	a bit stiff a bit dense*	rigid mushy*
pH	3.2-4.2	4.2-4.5	4.5-4.8	> 4.8

Sources: Bolsen and Sapienza (1993); *= physical quality assessment of banana stem silage (Syarifuddin 2008).

III. RESULTS AND DISCUSSION

The Captive Breeding Area

The captive breeding area of Timor Deer (*Cervus timorensis*) is located in Wosu Village, West Bungku Subdistrict, Morowali District, Central Sulawesi Province. It is about 509 km from Palu, the capital city of Central Sulawesi Province. The captive breeding site has an area of about 20 ha which is divided into three paddocks separated one another with wooden fences. The area itself is surrounded by both wooden and iron fences.

The vegetations that were found to grow within the captive breeding area consisted of trees, forages and other plants that are potentially used as a source of feed by the Timor Deer. The trees function as shelters for the animals in which the area under the tree canopy are used by the animals for day napping and resting while regurgitating the swallowed feeds. The total population of the Timor Deer contained in the captive was 235 heads; consisting of 65 bucks, 76 does, and 94 fawns and young deers. The body weight of bucks ranged from 65 to 75 kg, does from 45 to 60 kg, while those of fawns and young deers ranged from about 5 to 35 kg (Arifuddin *et al.*, 2018)

Quality of Feed Silage

The results of the physical and chemical quality assessment of silage made as an alternative feed for Timor deer are presented in Table 3. Based on the criteria of Bolsen & Sapienza (1993), Bolsen et al. (2000) and Syarifuddin (2008), in general the quality of the three types of silage is included in the good or appropriate category. The suitability of the quality of the resulting silage is influenced, among other things, by the use of molasses as much as 3% in the manufacturing process. From the physical aspect of silage, the use of molasses containing carbohydrates (sucrose) which is a disaccharide group is easily utilized by microbes during the fermentation process to produce lactic acid, resulting in a decrease in pH resulting in sour-smelling silage. Under acidic conditions the growth of fungi and putrefactive bacteria is inhibited so that the colour and texture of the silage is still the same as before, not moldy and not slimy (Said 1997, Lado 2007). From a chemical point of view, the acidic atmosphere that occurs in the fermentation process causes an increase in the death of spoilage microbes because they cannot stand in an acidic environment, and as a result, the crude protein content of silage increases (Darmono 1993).

Furthermore, Fathul (1997) stated that the newly formed protein in silage was a combination of free N from bacterial carcasses and volatile fatty acid residues (a mixture of acetic, propionic and butyric acids) which had lost O, N and H ions. and H is due to the increase in temperature during the fermentation process. According to Wahyuni and Bijanti (2006) the addition of 3% brown sugar and rice bran can be also increasing energy and rumen microbial population, so that microbial activity in the rumen increases in destroying lignin, cellulose and silica bonds. This means that both physically and chemically, the three types of silage made namely rice straw silage (SSP), maize straw silage (MSS) and palm oil leaf silage (POLS) can be said to meet quality standards as alternative feed for timor deer.

Table 3. Physical and chemical quality of silage

Assesment Criteria	Rice Straw Silage (RSS)	Maize Straw Silage (MSS)	Oil Palm Leaf Silage (OPLS)
Physically:			
Smell	acid	acid	acid
Plavor	acidity	acidity	acidity
Colour	light brown	light brown	Green
Fungi and Lenders	nothing	nothing	nothing
Textur	limp not stiff	limp not stiff	limp not stiff
pH	4	4	4
Chemically ⁽¹⁾ :			
Organic matter (%)	72,58	72,58	67,88
Crude protein (%)	20,85	18,25	13,45
Crude fiber (%)	7,37	8,47	6,47
Crude fat (%)	1,29	1,43	1,19
Ash (%)	14,27	11,59	15,33
Beta-N(%)	47,80	43,32	53,30
Energy of Bruto (kal/gram)	3720	3980	3470
Quality	Good/suitable	Good/suitable	Good/suitable

Source: ⁽¹⁾The results of the analysis of the Animal Nutrition and feed Laboratory, Department of Animal Husbandry, Tadulako University, Palu

Response of Timor deer for silage feed on feeding behavior

Eating behavior is a basic behavior to maintain life. Naturally, every animal, including the Timor deer, will make efforts to adapt (adaptation) to

changes in environmental conditions to maintain its survival, including its response to silage feeding because it is different from its natural habit of eating grass or fresh forage (Afzalani et.al. 2008). The response of the adaptation behavior of the Timor deer is gradual, so technically in this study, silage feeding is carried out gradually in the morning and evening before being given fresh forage. Silage feed is provided separately with fresh forage.

The results of the observation that at the beginning of giving silage, Timor deer showed investigative behavior (probing) which was marked by an attitude of stopping the activity they were doing and then remaining silent for a while while holding their head up showing an alert attitude. Furthermore, the Timor deer walked (moving) closer to the feed and smelled the silage feed while making a sound. This is done repeatedly while occasionally trying to eat or taste silage feed. It can be seen that the Timor deer exhibited a tendency to like the smell of silage, which smells of acidity like the smell of tape, which is indicated by smelling and starting to eat the silage that is given little by little. This shows that gradually and gradually deer show behavior like silage feed. The development of eating behavior is in accordance with Parakkasi's (1995) statement that smell is a major factor in food selection. If the animal does not like the food, the animal will show the behavior of refusing a food ingredient without tasting it first.

The results of further observations that the Timor deer showed selective behavior in consuming the given silage type indicated the order of the palatability of the Timor deer to the silage type of feed. Timor deer repeatedly show eating behavior by first eating corn straw silage, then palm leaf silage, and finally rice straw silage. This means that Timor deer tend to prefer corn straw silage and oil palm leaf silage compared to rice straw silage. The results also showed that the Timor deer did not show any symptoms of metabolic disorders such as diarrhea or abnormalities in their feces, so that physiologically the consumption of silage did not have a negative effect on the Timor deer. From the development of the level of consumption of silage feed given, it is generally seen that the daily consumption of Timor deer on silage tends to increase with increasing time of administration. This means that there is a better development of the adaptability of the Timor deer to silage feeding. The phenomenon of the development of the eating behavior of the Timor deer as a ruminant animal is in line with the statement of Bale-Therick *et.al* (1995) which states that ruminants have a fairly high selective nature of the available feed ingredients, have a sensation of feed ingredients before and

during eating and require adaptation time for feed ingredients. which had never been eaten before.

Based on the above phenomena, it can be concluded that the Timor deer in captive in the village of Wosu Kab. Morowali gave a positive feeding behavior response to silage feeding. Silage feed also does not cause metabolic disorders in Timor deer so that it can be used as an alternative feed in order to enrich Timor deer feed in captive. The results of this study reaffirm the Timor deer as a type of animal that is known to easily adapt to changes in feed (Semiadi and Nugraha (2004).

Silage Feed Palatability

Palatability is a performance characteristic of feed ingredients as a result of the physical and chemical conditions possessed by feed ingredients which are reflected by their organoleptic properties such as appearance, smell, taste (bland, salty, sweet, bitter), texture and temperature, which fosters attractiveness and stimulates animals to consume (Kartadisastra 1997). The results of the palatability analysis of the three types of silage as alternative feed showed that Timor deer preferred maize straw silage compared to oil palm leaf silage and rice straw silage with a palatability index as presented in Table 4.

Table 4. Palatability index and average amount of consumption

Parameters	Feed Silage		
	RSS	MSS	OPLS
Average amount of consumption (kgBS/ind/h)	0.93 ^a	1.37 ^a	1.14 ^a
Average amount of consumption (kgBK/ind/h)	0.64 ^a	0.88 ^a	0.90 ^a
Palatability index	0.25 ^a	0.74 ^b	0.42 ^b

Description: RSS= Rice Straw Silage; MSS =Maize Straw Silage,; OPLS = Oil Palm Leaf Silage. The same letters were not significantly different at 0.05.

The type of silage feed had a significant effect ($P < 0.05$) on palatability, then the smallest significant difference test showed that the palatability of rice straw silage (RSS) was significantly different from the palatability of maize straw silage (MSS) and oil palm leaf silage (OPLS). The difference in the level of palatability of these three types of silage is thought to be influenced by the relative differences in silage from a physical and chemical perspective. In terms of chemistry, maize straw silage has a crude fat content (1.43%) relatively higher than oil palm leaf silage (1.19%) and rice straw silage (1.29%). According to Blakely & Bade (1985) and Parakkasi

(1995) high crude fat content in feed can increase palatability and consumption. According to Tillman *et al.* (1998) that feed consumption depends on palatability, amount of feed and environmental influences. Dryden (1999) states that the amount of dry matter consumed is influenced by several factors, namely, (a) physical or chemical properties of feed, (b) physiological demands of livestock for basic living and production according to the capacity of the digestive tract, (c) related live weight. with the development of the digestive tract, because in general the capacity of the digestive tract increases with live weight so that it can accommodate large amounts of dry matter.

The high palatability of maize straw silage is also thought to be caused by the habits of Timor deer which have been consuming fresh elephant grass as their preferred feed. This means that the maize straw silage given has relatively physical color, taste and texture that are not much different from other fresh forages that have been consumed by the experimental Timor deer. Physically, the high palatability of feed maize straw silage and oil palm leaf silage is also suspected because the sizes of these two silages are relatively smaller than rice straw silage as stated by Parakkasi (1995) that a smaller silage physical size can increase consumption. The low palatability and consumption of rice straw silage is also thought to be voluminous in nature, in other words, it can be stated that the smaller silage is preferred by the Timor deer (palatable) over the voluminous silage.

IV. CONCLUSION

- The quality of silage shown that in the good/appropriate category and meets the minimum standards for ruminants.
- Timor deer in captive gave a positive and adaptive feeding behavior response to silage as an alternative feed and tended to like corn straw silage and oil palm leaf silage, and did not like rice straw silage.
- Timor deer prefer corn straw silage compared to palm leaf silage and rice straw silage based on palatability index

REFERENCES

- [1] Afzalani. Muthalib. R. A. dan Musnandar. E. 2008. Preferensi pakan, tingkah laku makan dan kebutuhan nutrisi rusa sambar (*Cervus unicolor*) dalam usaha penangkaran di provinsi jambi. Jurnal Media Peternakan. 31 (2):114 - 121.

- [2] Arifuddin, M.S., Utomo, R., Hartadi., Damry. 2014. Kajian nutritif pakan rusa timor (*Cervus timorensis*) di Lembah Palu. Disertasi. 2014
- [3] Arifuddin, M.S., Damry., Najamudin., Toknok.B., 2018. Produktivitas hijauan dan pemanfaatan limbah kelapa sawit untuk pakan tambahan pada rusa timor (*Cervus timorensis* de Blainville) di penangkaran. Laporan hasil penelitian, LPPM UNTAD.
- [4] Bale-Therik, J.F., F.A. Datta, G. Maranatha, B.C. Conterius dan M. Takandjandji. 1995. Budi daya rusa timor (*Cervus timorensis*) sebagai upaya pelestariannya di Nusa Tenggara Timur. Laporan Penelitian. Pusat Studi Lingkungan Lembaga Penelitian Universitas NusaCendana, Kupang.
- [5] Bolsen K, Ashbell G, Wilkinson JM. 2000. *Biotechnology in Animal Feeds and Animal Feeding: Silage Additive*. New York: Basel Cambridge.
- [6] Bolsen K, Sapienza. 1993. Teknologi Silase, Penanaman, Pembuatan dan Pemberiannya pada Ternak. Di dalam: Yusmadi. 2008. Kajian mutu dan palatabilitas silase dan hay ransum komplit berbasis sampah organik primer pada kambing peranakan etawah [Tesis]. Bogor: Institut Pertanian Bogor.
- [7] Crowder, L.V. and H.R. Chheda, 1982. *Tropical Grassland Husbandry*. Longman, London and New York.
- [8] Fathul. 1997. Kualitas gizi silase jerami jagung (*Zea mays*) dengan berbagai bahan media dan masa fermentasi yang berbeda. Di dalam: Asngad A. 2005. Perubahan kadar protein pada fermentasi jerami padi dengan penambahan onggok untuk makanan ternak. Jurnal Penelitian Sains dan Teknologi. 6(1): 65-74.
- [9] Lado L. 2007. Evaluasi kualitas silase rumput sudan (*Sorghum sudanense*) pada penambahan berbagai macam aditif karbohidrat mudah larut. Di dalam: Santi RK, Fatmasari D, Widdyawati SD, Suprayogi WPS. 2012.
- [10] Parakkasi A. 1995. *Ilmu Nutrisi dan Makanan Ternak Ruminansia*. Jakarta: UI Pr.
- [11] Semiadi G, Nugraha TP. 2004. *Panduan Pemeliharaan Rusa Tropis*. Bogor: Pusat Penelitian Biologi. LIPI.
- [12] Semiadi, G., Barry, T.N. Muir, P.D. 1998. "Perubahan Berat Badan Rusa Sambar (*Cervus unicolor*) pada kondisi padang rumput di daerah beriklim sedang. Bogor, Indonesia". Jurnal Biologi Indonesia. Bogor. 2: 104-108.
- [13] Syarifudin NA. 2008. Karakteristik dan persentase keberhasilan silase rumput gajah pada berbagai umur pemotongan. Di dalam: Santi RK, Fatmasari D, Widdyawati SD, Suprayogi WPS. 2012. Kualitas dan nilai kecernaan in vitro silase batang pisang (*Musa paradisiaca*) dengan penambahan beberapa akselerator. Tropical Animal Husbandry. 1(1): 15-23.
- [14] Tillman, A.D., H. Hartadi, R. Reksohadiprodjo, S. Lebdosoekojo, dan S. Prawirokusomo. 1998. Ilmu Makanan Ternak Dasar. Gadjah Mada University Press, Yogyakarta
- [15] Wahyuni RS, Bijanti R. 2006. Uji efek samping formula pakan komplit terhadap fungsi hati dan ginjal pedet sapi Fries.

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