PJN
ISSN 1680-5194

PAKISTAN JOURNAL OF NUTRITION

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorpjn@gmail.com

OPEN ACCESS Pakistan Journal of Nutrition

ISSN 1680-5194
DOI: 10.3923/pjn.2018.661.665

Research Article
Response to Palm Plantation Waste Fermentation as Forage and its Relation to the Increase in Buffalo Weight Gain

[1]Resolinda Harly, [2]Latifah Siswati and [3]Sri Mulyani

[1]School of Agriculture H. Agus Salim Bukittinggi, Indonesia
[2]Lancang Kuning University, Pekanbaru, Riau, Indonesia
[3]Tamansiswa University, Padang, West Sumatra, Indonesia

Abstract

Background and Objective: Ruminant cattle such as buffalo need green plants as their main food source to support life and growth. Green plants are usually taken from local grasslands as well as farming waste. However, the current situation indicates that the green plant supply has decreased, especially during long droughts. Palm oil plantations play a primary role in supporting the green plant supply for the cattle as they produce industrial and agricultural waste. For individual agriculture, green plants that can be consumed by the cattle include midribs and the palm leaves. Palm oil agricultural waste contains high amounts of crude fiber, so fermentation and aeration are important to improve the quality of agricultural waste as well as green plants that contain high amounts of crude fiber. This work discusses the capability of buffalo to process palm oil waste, especially the palm leaves without sticks, that has been fermented and its relation to the increase in buffalo weight. The objective of this research was to explain the ability of buffalo to digest fermented palm leaves, which consistently increase the daily weigh. **Materials and Methods:** This field research was conducted in Lubuk Basung, Distric Agam from April-May, 2017. Daily weight gain of buffalos was measured and amount of fodder was calculated. **Results:** The results show that the fermentation of palm leaves without sticks may increase the daily weight gain by approximately 0.89±0.33 kg/buffalo/day, while the consumption of fodder is approximately 18.9±0.74 kg/buffalo/day. **Conclusion:** Palm waste as forage exhibits a positive impact on the daily weight gain of buffalo.

Key words: Buffalo, daily weight gain, palm leaves, green plants, palm oil waste

Received: November 08, 2017 Accepted: July 04, 2018 Published: November 15, 2018

Citation: Resolinda Harly, Latifah Siswati and Sri Mulyani, 2018. Response to palm plantation waste fermentation as forage and its relation to the increase in buffalo weight gain. Pak. J. Nutr., 17: 661-665.

Corresponding Author: Resolinda Harly, School of Agriculture H. Agus Salim Bukittinggi, Indonesia

Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Ruminants need grass and green plants as their main food to live. These plants are usually taken from the local grassland as well as farming waste. However, the current situation is that the green plant supply has decreased as a result of the alteration of land function from farming to housing, public facility and plantation. Palm oil plantations have a primary role in supporting the green plant supply for cattle and this supply can be composed of industrial and agricultural waste. For individual agriculture, the green plants that can be consumed as a food supply for the cattle include midribs and the palm leaves. In 2014, Indonesia had 10.75 million of palm oil plantation[1] (41% of this plantation belongs to the local farmers, 7% is owned by the government, while the rest 52% is private farm). Sumatra and Borneo has 6.80 and 3.45 million hectare palm oil plantation respectively. Palm oil plantations may produce 20 to 30 palm plants, which is equal to 10 tons of dry leaves/ha/year[2,3]. Each palm oil plant produces 25-30 or in average 27 stem bark annually[3]. The average weight of stem bark is 5 kg/trunk, while each stem may contain 0.5 kg of palm leaves. Subhan *et al.*[3] had previously calculated that the average number of palm oil trunks in one hectare of land is approximately 136 plants, which indicates that palm oil plantations may produce at least 197,37 million t of stem bark and 731 thousand t of palm leaves.

Palm oil agricultural waste contains high amounts of crude fiber and processing is needed to improve the quality of the waste. Fermentation and aeration are applicable in improving the quality of agricultural waste as well as green plants that contains high amounts of crude fiber. The results of Hasan[4], which are mentioned in Ginting and Elizabeth[5], indicated that adding urea continuously as much as 3 times or to a concentration of 6% will increase the protein from 5.6-12.5% and even 20%.

Buffalos have a unique ability compare to ruminants and other herbivores . Their uniqueness can be seen in the habitats where they live, their morphological characteristics, anatomy, digestion physiology and their nutritional status. Both the digestion physiology and the capacity of buffalo's stomachs show exceptional abilities and characteristics in digesting low-quality grass (low-protein plants and plants with high amounts of crude fiber). Buffalo also have an incredible pace of compensatory growth compared to cows[6,7].

This article discusses the capability of buffalo to process palm oil waste, especially the palm leaves without sticks, that has been fermented and its relation to the increase in their weight. As palm oil plantations have plenty of palm leave stocks that can be used as the main forage, farmers can benefit from these surpluses. This research is designed to verify buffalo's ability to digest fermented palm leaves to increase daily weight gain.

MATERIALS AND METHODS

This study used four male buffalos ranging from 18-27 months old. The average weight of buffalo was 354±36.68 kg and each animal was fed with modified feed from Lazuardi M.A. Sumardi and Bagus (Table 1).

Research execution: The fermentation process of palm leaves was as follows:

- Separating palm leaves and sticks
- Cutting the leaves with a chopper to make them smaller, approximately 2-3 cm
- Adding other ingredients such as bran, urea, ultra mineral, salt, starbio, molasses accordant with the composition of palm leaves and then combining them together
- Fermenting the ingredients for 10 days and after the procedure, the mixture is aerated for 30 min before it is given to the buffalos
- Feeding the buffalos with the modified diet from the fermented palm leaves. Diet was given to buffaloes two times a day, first in the morning before the buffalo are freed into the farming area and again in the afternoon at approximately 5 pm before they are tied up in the palm oil plantation

Observation and measurement:

- Adaptation is conducted for two weeks
- Time for forage adjustment is approximately two weeks
- Parameter observation is performed for at least eight weeks
- In calculating the amount of fodder that is given to the buffalo, the researcher counts the total fodder that is given minus the leftovers
- The daily weight gain is measured with measuring tape every seven days for at least four weeks

Table 1: Food composition of fermented palm oil plant

Ingredients	Composition (g)
Palm leaves	750
Bran	150
Urea	20
Ultra mineral	10
Salt	10
Molasses	40
Starbio	20

RESULTS

The results indicate a daily weight gain for the buffalo of 0.89±0.33 kg/head/day. The feed consumed by buffalo was 18.9±0.74 kg/head/day. The research was initiated with an initial weight measurement of the buffalo of 354±36.68 kg/head and the final weight of the buffalo after the research was 380±41.11 kg/head.

Nutrition and fiber fraction of palm leaves: The content of fiber fraction of palm leaves before and after 10 days fermentation is shown on Table 2.

Digestibility: The benefits of certain fodder are known from the analysis of animal digestibility as the chemical analysis provides only the value of the fodder without mentioning the benefit. McDonald *et al.*[8] stated that food digestibility is affected by the chemical composition of the fodder as well as the fraction of the fiber in the food. During this field study, the laboratory analysis of the digestibility of fermented palm leaves exhibited significant changes as they cause digestive improvement especially for dry forage, organic, crude protein and fiber, NDF, ADF, hemicelluloses as well as cellulose. The improvements were found to be approximately 20.53, 9.52, 27,16, 17.15, 14.90, 13.32, 31.02 and 18.11%.

DISCUSSION

The response to the diet is indicated by the buffalo's ability to consume certain foods and is calculated by reducing the quota of the given food and replacing it with left over food. The results show that the palatability exhibits no significant problems after feeding the buffalo with fermented palm leaves. Table 2 shows that the impact of the consumption of fresh green plants on buffalo was approximately 18.9±0.74 kg and that each had an increase in daily weight gain of approximately 0.89±0.33 kg. Batubara[9] and Rohaeni[10] indicated that giving a diet of 40% palm leaves and concentrate will increase the daily weight gain of male buffalo by approximately 0.76 kg. Moran[11] and Suhubdy[6] indicated that male buffalo may grow at the rate of 0.59 and 0.73 kg/day after feeding with concentrated food at concentrations of approximately 30 and 70%. The increase in weight gain of approximately 0.764-0.832 kg/day requires 2 kg of concentrated food[12,13]. In this research, the diet has been arranged with concentrate, urea and molasses as shown in Table 1. As a result, the increase in daily weight gain of buffalo is greater than that in the previous research by Sariubang *et al.*[12].

The level of fodder consumption is influenced by several factors such as age, weight, palatability and health. An approach to increase the green plant consumption is improving the palatability of the fodder by adding attractants such as salt and sweetener or by adding protein. The level of dried plant consumption is approximately 9.68 (kg/day), which is 2.73% of the total weight. The level of consumption is higher than the result collected by Moran[11] and Kuswandi[13], who stated that the consumption of 5.80 kg/day dry food, equal to 1.81% of the total weight of a living buffalo, may lead to a weight of 320.10 kg, while the increase of daily weight gain is

Table 2: Nutrition substance on palm leaves without stick

Ingredients	Palm leaves before fermentation (%)	Palm leaves after fermentation (%)
Dry ingredients	55.73	51.25
Organic ingredients	82.46	80.78
Crude protein	7.84	13.85
Crude fat	2.26	3.47
Crude fiber	30.68	25.91
Ask	14.08	11.37
BETN	45.14	41.60
NDF	69.40	60.12
ADF	48.71	35.67
Cellulose	20.94	16.22
Hemicellulose	20.69	24.45
Lignin	11.89	9.03

Source: Vansoest Laboratory Analysis of Ruminant Nutrition Husbandry Faculty, Andalas University

Table 3: Digestibility of nutrients found in palm leaves without sticks as analyzed *in vitro*

Palm leaves	DM	OM	CP	CF	NDF	ADF	Hemi	Cell
Before the fermentation	51.78	59.86	56.38	51.48	42.14	27.48	41.26	39.71
After the fermentation	62.41	65.56	71.69	60.31	48.42	31.14	54.06	46.46

Source: *In vitro* Ruminant Nutrition Laboratory Analysis at Husbandry Faculty Andalas University, DM: Dry matter, OM: Organic material, CP: Crude protein, CF: Crude fiber

approximately 0.73 kg/day. The level of consumption is determined from the total weight, while the increase in the consumption level is influenced by age. Parakkasi[14] indicated that the growth rate of a buffalo is determined by the age and that puberty indicates optimal growth. As the buffalo becomes an adult, the growth is decreased. In this research, the animals were approximately 18-27 months old, a time during which the buffalos were still growing.

The analysis shows that palm leaf fermentation measurement as shown in Table 1 improves buffalo digestibility by 20.52% and also improves the organic digestibility by 9.52%. An improvement can also be found in the crude fiber digestibility as the fodder given to the animals is the form of complete fodder by adding starbio, which consists of protein, to improve crude fiber digestibility. Imsya[15] also stated that an increase in the protein level during palm leaf fermentation is the result of the breakdown of organic substances, which change the percentage of substrate nutrients. Urea has the ability to loosen the bond between lignin and hemicellulose. As a result, lignin content is increased, while some parts of cellulose are decreased, both lignin and silica are dissolved and result in enzyme penetration, which is produced by rumen microbes that later improve the level of digestibility as indicated by Wannapat *et al.*[16] and Sundstol[17]. Macro minerals are needed in small amounts but play crucial roles in rumen.

The results imply that fermented palm leaves may increase the daily weight gain of buffalo and that this approach can be applied as a solution during droughts when green fodder is scarce. This research encourages other parties to pay attention to buffalo fodder and its relation to weight gain. However, this research may have weaknesses, as farmers have limited knowledge about palm leaf fermentation processes and procedures and thus, supervision is needed.

CONCLUSION

The application of palm leaf fermentation will improve the daily weight gain of buffalo as much as 0.89 kg/buffalo/day. The level of dry fodder consumption is approximately 9.68 kg/day with a consumption of dry rations by buffalo of approximately 2.73% of the total weight. The results indicate that using the palm plantation waste to feed the buffalo will also support the meat supply.

SIGNIFICANCE STATEMENT

This research explores the possibility of using palm leaves as the main fodder for buffalo, which can be beneficial for farmers in increasing buffalo weight gain. This study will help researchers to explore the critical area of fodder modification and its relation to daily weight gain, an area that many researchers were not able to explore previously. Thus, a new theory can be developed on fodder combination using fermented palm leaves and other combinations.

ACKNOWLEDGMENT

Authors would like to thank the Research and Community Service Directorate as well as the Ministry of Research, Technology and Education, which supported the research project through MP3EI.

REFERENCES

1. Badan Pusat Statistik, 2015. Statistik kelapa sawit Indonesia 2015. Badan Pusat Statistik. Jakarta.
2. Fauzi, Y., Y.E. Widyaastuti, I. Satyawibawa and R. Hartono, 2003. Kelapa sawit, budidaya, pemanfaatan hasil dan limbah, analisa, usaha dan pemasaran. Penerbit Penebar Swadaya, Jakarta.
3. Subhan, A., E.S. Rohaeni and A. Hamdan, 2008. Potensi pemanfaatan limbah perkebunan sawit sebagai pakan alternatif ternak sapi pada musim kemarau di kabupaten tanah laut. Balai Pengkajian Teknologi Pertanian Kalimantan Selatan, Jl. Panglima Batur Barat, No. 4.
4. Hasan, A., 1993. Oil palm frond silage as a roughage source for milk production in Sahiwal Frisien cows. Proceedings of the 16th Malaysian Society of Animal Production, June 8-9, 1993, Langkawi, Malaysia, pp: 34-35.
5. Ginting, S.P. and J. Elizabeth, 2012. Teknologi pakan berbahan dasar hasil sampingan perkebunan kelapa sawit. Lokakarya Sistem Integrasi Kelapa Sawit-Sapi, pp: 129-136.
6. Suhubdy, 2007. Strategi penyediaan pakan untuk pengembangan usaha ternak kerbau. Wartazoa, Vol. 17.
7. Lazuardi, M.A., H.S. Sumardi and M.B. Hermanto, 2013. Pengembangan pakan ternak ruminansia alternative (bahan dasar daun kelapa sawit, palem dan kelapa). J. Keteknikan Pertanian Biositem., 1: 35-42.
8. McDon3ald, P., R.A. Edwards, J.F.D. Greenhalgh and C.A. Morgan, 1995. Animal Nutrition. 5th Edn., John Wiley and Sons, Inc., New York.
9. Batubara, L., 2002. Potensi biologis daun kelapa sawit sebagai pakan basal dalam ransum sapi potong. Proceedings of the Seminar of Nasional Teknologi Peternakan dan Veteriner, September 30-October 1,2001, Bogor, pp: 135-138.

10. Rohaeni, E.S., 2014. Potensi limbah sawit untuk pakan ternak sapi di Kalimantan Selatan. JITV., 19: 170-177.
11. Moran, J.B., 1985. Comparative performance of five genotypes of Indonesian large ruminants. 1. Effect of dietary quality on liveweight and feed utilization. Aust. J. Agric. Res., 36: 743-752.
12. Sariubang, M.M., D. Pasambe and A. Ella, 2003. Kajian reproduksi dan produksi kerbau lumpur di Kabupaten Tanah Toraja Sulawesi Selatan. Proceedings of the Seminar of Nasional Peternakan dan Veteriner, September 29-30, 2003, Puslitbang Peternakan, Bogor, pp: 60-63.
13. Kuswandi, 2007. Peluang pengembangan ternak kerbau berbasis limbah pertanian. Wartazoa, 17: 137-146.
14. Parakkasi, A., 1997. Ilmu nutrisi dan makanan ternak ruminansia. Universitas Indonesia, Jakarta.
15. Imsya, A., 2013. Hasil biodegradasi lignoselulosa pelepah kelapa sawit (*Elais guineensis*) oleh *Phanerochaete chrysosporium* sebagai antioksidan dan bahan pakan ternak ruminansia. Master's Thesis, Sekolah Pascasarjana, IPB., Bogor.
16. Wannapat, M.S., S. Praserdsuk, Chatai and Sivapraphagon, 1982. Effect of rice straw ulization of treatment with ammonia released from urea and or supplementation with qasava chips. Proceedings of the 2nd Annual Workshop of the AFAR Research Network, May 3-7, 1982, UPM, Malaysia.
17. Sundstol, F., 1991. Large Scale Utilization of Straw for Ruminant Production Systems. In: Recent Advances on The Nutrition of Herbivora, Ho, Y.W., H.K. Wong, N. Abdullah and Z.A. Tajuddin (Eds.)., Society of Animal Nutrition, Malaysia.