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Usage of Selective Local Crops for Goat Feeds to Increase Milk and Meat Yield

Afzan Mat Yusof [1,2*], Mohd Hishammfariz Mohd Amin[3]

Department of Basic Medical Sciences, Kulliyyah of Nursing, International Islamic University Malaysia, Jalan Sultan Ahmad Shah, Bandar Indera Mahkota, 25200 Kuantan, Pahang, Malaysia[1],
Integrated Cellular and Molecular Biology Cluster (iMolec), International Islamic University Malaysia, Jalan Sultan Ahmad Shah, Bandar Indera Mahkota, 25200 Kuantan, Pahang, Malaysia[2],
Livestock Industry Division, Ministry of Agriculture and Agro-based Industry, Blok 4G1 Wisma Tani, No. 28 Persiaran Perdana Presint 4, Pusat Pentadbiran Kerajaan Persekutuan, 62624 Putrajaya, Selangor, Malaysia[3],

Abstract— The success of goat's milk and meat production relied on the types of feeding materials. The use of imported crops is common leading to underutilization of local crops. Local crops or new feed was formulated to compare with the existence imported crops or old feed used by the goat farmers. Goats' body weight gain and daily milk yield were measured as indicators of the feed formulation efficacy and goats' performance. Twenty adults female Saneen goats (30-35 kg) were fed with two different feed formulations for six months. The goats were fed with imported feed (Diet 1) for the first three months and continued with local crops feed (Diet 2) for the next three months. The goats fed with Diet 2 showed higher body weight gain and milk production than Diet 1. The implementation of feed formulation using local crops is recommended as it increases goats' milk and meat production.

Keywords— Local crops, feed formulation, milk production, body weight.

1. Introduction

Ruminant industry has developed rapidly over the years to meet up with the population's demand. Apart from that, this industry also gained its momentum due to its high economic returns. In Malaysia, the establishment of commercial goat farms, especially smallholder farms, has become popular because of the goats' productivity for milk and meat supplies [5]. Nevertheless, the key to high turnover from this ruminant industry is closely related to the agro-industrial growth. This is because agro-industry has the capability to supply its byproducts and crops residues for livestock feed [20].

The importance of maintaining nutritious livestock feed emphasizes the need to sustain a good resource of forage and crops either imported or local. High levels of animal health and performance are dependent on high quality nutrition and proper feed management. Nutrition is often limiting the productivity of ruminants whether it is expressed as growth rate, multiple births, milk production, or resistance towards diseases [3]. One of the main problems in the ruminant industry in Malaysia is the shortage of suitable forages or feeds, both in terms of quantity as well as quality of feed available [10].

Malaysia is characterized as lack of natural grasslands even though located at an equatorial climate with adequate sunshine and rainfall all year round due to the land usually used for other agricultural purposes [10]. This leads to the necessity of importing feeds and forages for the livestock industry. Massive importation of feed has been practiced in our country to prosper the ruminant industry growth over the decades. Imported feed are more commonly used by local farmers as it is believed to have higher quality and capability in promoting goats' productivity [13]. However, imported crops are expensive and continuous practice is

expected to be non-cost-effective. Thus, a major effort to reduce the burden of feed imports is to increase the use of local feed resources [7].

Over the past 3 decades, there has been an increment in the number of researches done to look for alternatives and substitutes [20]. Studies have been reported on enhancing livestock feed from the locally available feed ingredients with prominent nutrient value. The list includes evaluation and utilization of broken rice, bran, pineapple waste, *Mallotus* sp., *Sesbania* sp., *Musa* sp. and commercial grain production; in hope for the goal of import substitution and self-sufficiency can be fulfilled [15]. Hence, the study aims to provide proper feeding regime using selective local crops on goats towards sustainable milk and meat production.

2. Materials and methods

2.1. Time and Study Area

This study was conducted at a commercial farm in Kuantan, Pahang for a period of 90 days from March 2018 until May 2018.

2.2 Selection and Grouping of Animals

In this study, 20 female Saneen goats aged one-year-old and weighing in the range of 30-40 kg were selected. The goats in the farm were mainly for milk and meat production's purposes.

2.3 Formulation of Diets

Two different diets were formulated and given to the goats. Both diets consist of different feed ingredients such as Pennisetum sp. (Napier grass), processed soy waste, Mallotus sp., Sesbania sp., Musa sp. and palm kernel concentrate. The amount of feed formulations given is shown in Table 1.

2.4 Nutrient Requirements Assessments

The nutrient composition of the feed ingredients given to the goats for Diet 1 and Diet 2 were determined by proximate analysis. Proximate analysis is the most common analysis procedures of the AOAC (2005) performed on feed samples where it consists of a series of analyses to estimate the nutrient characteristic of feeds which includes the following: dry matter, coarse protein, energy content, and crude fibre which shows in Table 2.

2.5 Feeding of Animals

The goats were fed according to the assigned feed formulations and kept in their individual pens for monitoring purpose throughout the experimental period of 90 days. The feeding trial for each diet lasted for 90 days (day 0 to day 90) starting with Diet 1 which is referred as old feeding regime and followed by Diet 2 which is referred as new feeding regime.

2.6 Measurement of Body Weight Gain

Body weight was measured before implementation (day 0) of the feeding regime and was done again at day 7, 14, 21 in every month for six months. The readings were recorded and tabulated for comparison according to a method by Shahudin et al., (2016). The body weight gain was calculated by using this formula, "Body weight gain (kg) = Final body weight (kg) – Initial body weight (kg)."

2.7 Measurement of Milk Yield

The milk collection was done twice daily, which were on 9am and 4pm. Milk yield measurement was done

before implementation (day 0) of the feeding regime and was done again at day 7, 14, 21, 28, 35, 42, 49, 56, 63, 70, 77, 84 and 90. The readings were recorded and tabulated for comparison.

3. Results and Discussion

Figure 1 shows the total milk yield for Month 1, Month 2 and Month 3 from 20 goats after fed with Diet 1 and Diet 2. After 90 days of feeding trial for the new feeding regime (Diet 2), the measurement for milk production showed approximately almost one and half or twice than old feeding regime. For Diet 1, the highest milk production in Month 1 is 6.98 L while the lowest milk production in Month 1 is 5.65 L. The highest milk production in Month 2 is 7.04 L while the lowest milk production in Month 2 is 5.7 L. The highest milk production in Month 3 for goats fed with Diet 1 is 7.0 L while the lowest milk production in Month 3 is 6.0 L. Meanwhile, for Diet 2, the highest milk production in Month 1 is 9.3 L while the lowest milk production in Month 1 is 7.38 L. The highest milk production in Month 2 is 10.0 L while the lowest milk production in Month 2 is 8.5 L. The highest milk production in Month 3 for goats fed with Diet 2 is 11.2 L while the lowest milk production in Month 3 is 10.0 L. For the new feeding regime (Diet 2), the milk yield in Month 3 is higher than the milk yield in Month 1. The highest milk yield in Month 3 is 11.2 L while the highest milk yield in Month 1 is 9.3 L. Meanwhile, the measurement for milk yield for the old feeding regime (Diet 1) showed little or no difference in three months. The highest milk yield in Month 3 is 7.0 L while the highest milk yield in Month 1 is 6.98 L.

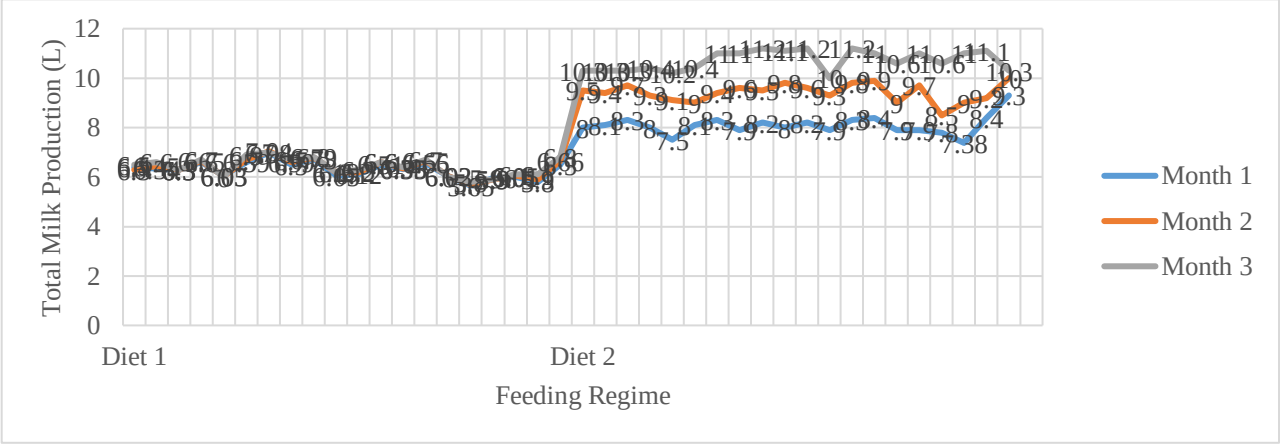

Figure 1: Total milk production of Diet 1 and Diet 2 of 20 goats in Month 1, Month 2 and Month 3. Each point represents the reading of the total milk production in a goat. Each goat was given Diet 1 for the first three months and Diet 2 for the next three months. Goats given with Diet 2 showed higher milk production yield in Month 3 than Month 1 than goats given with Diet 1 that showed similar production of milk in the three months.

Figure 2 shows the difference of milk production from 20 goats after fed with Diet 1 and Diet 2. The new feeding regime (Diet 2) showed higher milk production difference which is 3.4 L to 5.0 L. Meanwhile, old feeding regime (Diet 1) showed little milk production difference which is 0.0 L to 0.4 L. The highest milk production difference in Diet 2 is 5.0 L while the highest milk production difference in Diet 1 is 0.4 L. Diet 2 consists of forages such as Mallotus sp., Sesbania sp., and Musa sp. that contain higher protein content than Diet 1.

The total milk production from the implementation of Diet 2 is higher as compared to Diet 1. On average, after implementation of Diet 2, daily milk yield per goat can reach up to 4 litres increment. Diet 1 contains processed soy waste and palm kernel pallet while Diet 2 contains Mallotus sp., Sesbania sp., and Musa sp. The combination of feed ingredients in Diet 2 has higher composition of crude protein (CP) percentage than

Diet 1. Diet 2 contains high percentage of crude protein than Diet 1. High protein contents either as supplement or directly added in goats feed is known to enhance milk yield [2]. Milk production requires a high level of protein and most of goat farmers give goats with feeds that are low in protein level [19]. Goats fed with Diet 1 shows lower milk production than goats fed with Diet 2. Diet 1 contains processed soy waste that may has relatively low protein efficiency due to extensive ruminal degradation and limited use in high-producing ruminants such as Saanen goats in this study. Low protein efficiency in ruminant feed may lower the milk production in goats. Processed soy waste in Diet 1 need to be treated properly in order to increase protein efficiency and destroy anti-nutritional factors in order to provide benefits to the ruminants and increase milk yield [12]. Besides that, lower milk production in goats fed with Diet 1 might be due to growth of molds in processed soy waste with excessive moisture. Molds produce aflatoxins that toxic to livestock and interrupt the absorption and breakdown of feed's nutrients. Animals that been exposed to moldy feeds might show reduced feed consumption, diarrhea, reduced gains and reduced milk production [11]. In order to enhance the milk production yield in goats, farmers need to provide the goats with feeds that contain high crude protein level like Diet 2 in this study. Sufficient feeding materials is one of the good management practices that need to be implemented by every farm owner in order to achieve a better performance of the livestock.

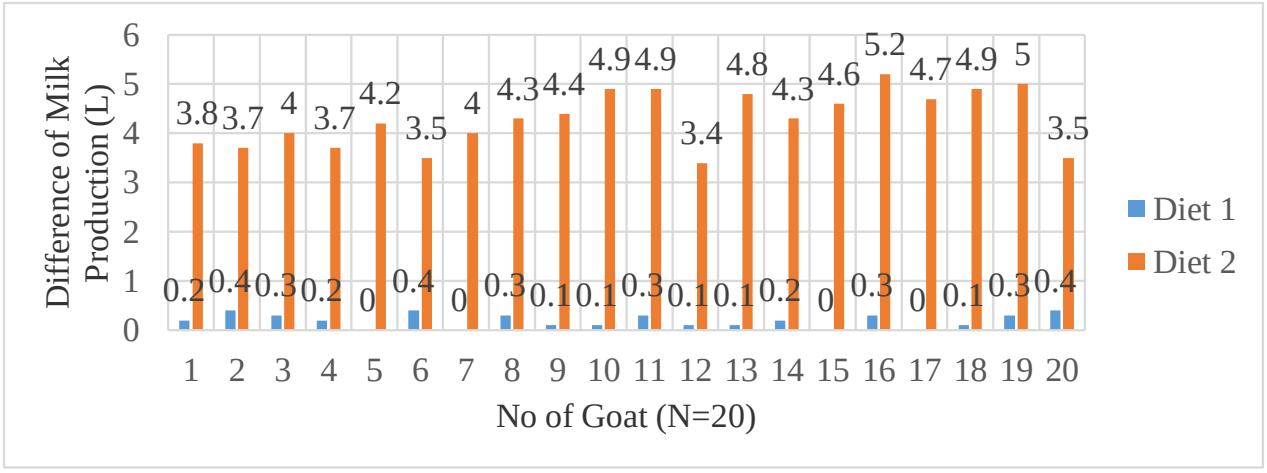

Figure 2: Difference of Milk Production of Diet 1 and Diet 2 in 20 goats. Each bar represents the difference of milk production from Day 0 to Day 90 in each goat. The goats fed with Diet 2 showed larger difference of milk production which is 3.4 L to 5.0 L than the goats fed with Diet 1 which is 0.0 L to 0.4 L.

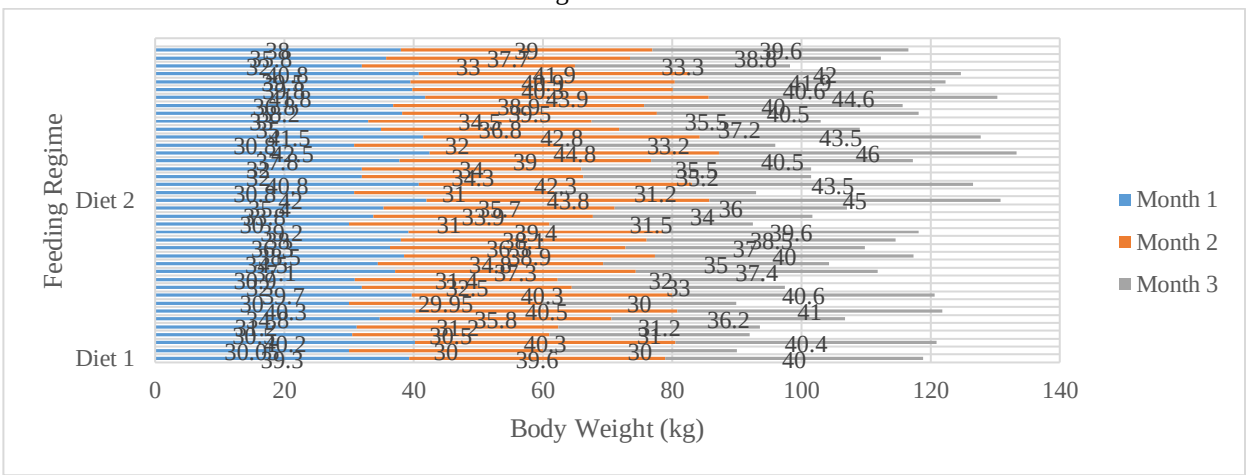

Figure 3: Body weight of 20 goats when given Diet 1 and Diet 2 in Month 1, Month 2 and Month 3. Each point represents the body weight of a goat. Each goat was given Diet 1 for the first three months and Diet 2 for the next

three months. Body weight were measured in Day 7, 14, 21 and 28 of the three months. The goats fed with Diet 2 showed higher body weight than goats fed with Diet 1.

Figure 3 shows the body weight of 20 goats for Month 1, Month 2 and Month 3 after fed with Diet 1 and Diet 2. The new feeding regime (Diet 2) showed higher body weight in Month 3 as compared in Month 1. Meanwhile, the old feeding regime (Diet 1) showed little or no body weight gain in the three months. For Diet 1, the highest body weight in Month 1 is 40.3 kg while the lowest body weight in Month 1 is 30.0 kg. The highest body weight in Month 2 is 40.5 kg while the lowest body weight in Month 2 is 29.95 kg. The highest body weight in Month 3 for goats fed with Diet 1 is 41.0 kg while the lowest body weight in Month 3 is 30.0 kg. Meanwhile, for Diet 2, the highest body weight in Month 1 is 42.5 kg while the lowest body weight in Month 1 is 30.8 kg. The highest body weight in Month 2 is 44.8 kg while the lowest body weight in Month 2 is 31.0 kg. The highest body weight in Month 3 for goats fed with Diet 2 is 46.0kg while the lowest body weight in Month 3 is 31.0 kg. The highest body weight in goat fed with Diet 2 is 46kg in Month 3 while the highest body weight in goat fed with Diet 1 is 41 kg in Month 3.

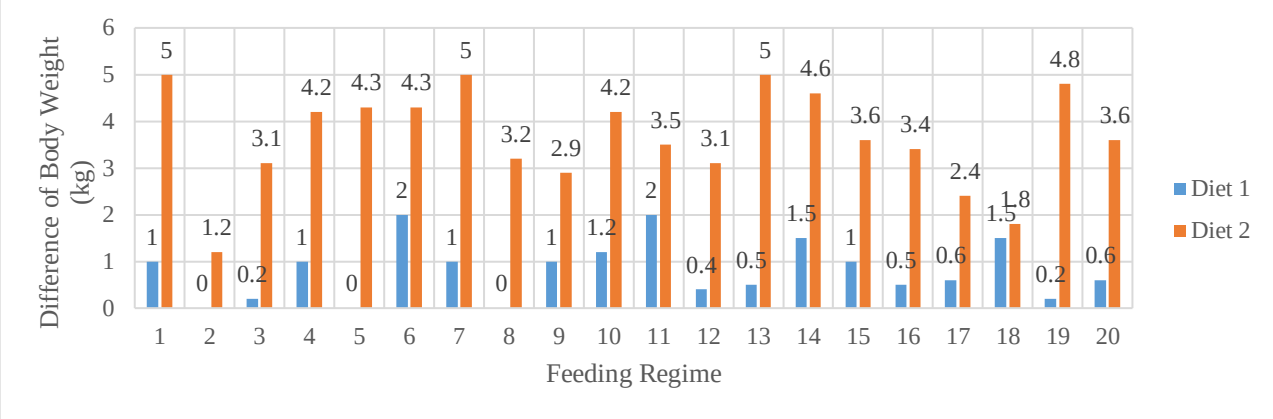

Figure 4: Difference of Body Weight Gain of Diet 1 and Diet 2 in 20 goats. Each bar represents the difference of body weight gain from Day 0 to Day 90 in each goat. The goats fed with Diet 2 showed larger difference of body weight gain which is 1.2 kg to 5.0 kg than the goats fed with Diet 1 which is 0.0 to 1.5 kg.

Figure 4 shows the difference of body weight gain from 20 goats after fed with Diet 1 and Diet 2. The new feeding regime (Diet 2) showed higher body weight difference which is 1.2 kg to 5.0 kg. Meanwhile, old feeding regime (Diet 1) showed little body weight difference which is 0.0 kg to 2.0 kg. The highest body weight difference in Diet 2 is 5.0 kg while the highest body weight difference in Diet 1 is 2.0. Diet 2 consists of forages with higher protein content which enables the reduction of concentrate (palm kernel pellet) used in the formulation. Diet 2 with higher protein composition shows a higher increment in body weight gain of all twenty goats than Diet 1.

Diet 2 consists of Mallotus sp., Sesbania sp., and Musa sp. with high crude protein percentage than Diet 1. High crude protein in local plants can improve weight gain in livestock and can be used as an alternative feed to the goats [17]. Diet 2 contains local plants such as Sesbania sp. that contains 20 to 25% crude protein and known as a plant with high protein level and high digestibility when consumed by livestock [6]. Higher intake of energy and protein in daily feed can enhance muscle distribution, physical and biochemical properties of the goat's body, muscle physical and body weight gain of the goats. Protein is essential for growth development and the deficiency in protein intake will decrease the digestion of carbohydrate in the livestock. Protein deficiencies can lead to poor growth rates and this problem can be prevented by enough supplementation of feed with high protein level [11].

Mallotus sp. had been used as an alternative feed source for livestock such as goats due to high protein and energy contents in the plant [17]. Mallotus sp. also contained high crude fat and dry matter that can stimulate the growth and nutrient intake of the goats [4]. Sesbania sp. is one of the protein rich supplement to livestock as it contains approximately 20 to 25% crude protein and the Sesbania leaves are easily digestible when consumed by livestock [14]. A study done by Rahman et al. (2015) showed that the goats that fed with Sesbania sp. exhibited higher weight gain, nitrogen balance and digestibility than the goats fed with green grass. Musa sp. is a plant that has high dietary fibres, crucial minerals such as sodium and potassium, vitamins such as A, B1, B2 and C and glucose. Livestock such as goats and cows are lack in glucose in their feed intake. Lactating goats need a good glucose supply in order to meet the milk synthesis demands. Lactating livestock can consume Musa sp. or banana leaves in order to increase the glucose level in the feed intake [9]. Livestock fed with banana leaves will exhibit higher body weight gain due to increased intake of dry matter and protein contents. From the literature above, it can be concluded that Sesbania sp., Mallotus sp., and Musa sp. contain higher dry matter, protein contents and other nutrients and promote the growth rate and milk production rate in livestock.

In fact, our study found that Sesbania sp., Mallotus sp., and Musa sp. had improved milk and meat yield in goats. Diet 2 has the ability to promote a healthier and more well-balanced diet for the goats than Diet 1. The milk and meat production are related to the health state of the goats. Thus, higher milk production and increase weight may also indicate a better health state for the goats.

4. Conclusions

In conclusion, throughout 90 days of the experimental period for each diet, the implementation of different feed formulation does affect the milk yield and body weight. Higher protein composition from local crops in daily diet intake suggested a more preferable feeding formulation. The suitability of these local crops also suggests the ability to substitute imported feedstock for goats. New feed formulations for pregnant goats and goat kids need to be produced too in order to improve goat's productivity.

5. Declaration of competing interest

The authors declare have no conflict of interest.

6. Acknowledgements

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7. References

[1] Association of Official Analytical Chemists (AOAC). 2005. Official Methods of Analysis. 18th Edition., AOAC. International, Gaithersburg, Maryland, USA.

[2] Azrul, LM., K. Poungpong, S. Jittapalapong, S. Prasanpanich. 2016. Short-term preliminary antihelmintic effect of Sesbania grandiflora in naturally parasitic infected goats with side effects observation. Livest. Res. Int. 4(1):18-22.

[3] Corson, D., G. Waghorn, M. Ulyatt, J. Lee. 1999. NIRS: Forage analysis and livestock feeding. Proceedings of the New Zealand Grassland Association. 61:127-132.

[4] Ghani, AAA., MS. Shahudin, R. Azrolharith, AR. Haizan, M. Zamri-Saad, AB. Zuki, H. Wahid, A. Kasim, MS. Salisi, YM. Goh, Y. Rosnina, HA. Hassim. 2017. The nutrient composition and in vitro ruminal degradability of selected local plants used as goat feed in Malaysia. J. Vet. Malaysia. 29(1):23-25.

[5] Ghani, AAA., MS. Shahudin, M. Zamri-Saad, AB. Zuki, H. Wahid, A. Kasim, MS. Salisi, A. Hafandi, H. Hamzah, NHA Daud, HA. Hassim. 2016. Feed formulation based on local feed resources and its effects on nutritional-related blood profile in breeder goats. Proceedings of International Seminar on Livestock Production and Veterinary Technology. Pp. 276-283.

[6] Gomase, P.V. 2012. Sesbania sesban Linn: A review on its ethnobotany, phytochemical and pharmacological profile. Asian J. Biomed. Pharm. Sci. 2(12):11.

[7] Hashim, M., M. Mohd Hazim, AM. Syafinie. 2015. Strategic forest plantation establishment in Malaysia for future product development and utilization. Proceeding-Kuala Lumpur International Agriculture, Forestry and Plantation. 1:14-24.

[8] Hossain, ME., M. Shahjalal, MJ. Khan, MS. Hasanat. 2003. Effect of dietary energy supplementation on feed intake, growth and reproductive performance of goats under grazing condition. Pakistan Journal of Nutrition. 2(3):159-163. Doi: 10.3923/pjn.2003.159.163

[9] Jais, MAB., NA. Jamion, HNM Rashid. 2017. Alternative livestock feed from fermented banana peel. Journal of Academia UiTM Negeri Sembilan. 5(2017):1-8.

[10] Kong, E.P. 2004. Forage development and research in Malaysia. FAO. Pp. 20-29.

[11] McKenzie-Jakes, A. 2007. Nutrition and Pasture Management for Meat Goats. Florida A&M University, Cooperative Extension Program.

[12] Newkirk, R. 2010. Soybean: Feed industry guide. Canadian International Grains Institute, Canada.

[13] Nhan, N.T.H. 1998. Utilization of some forages as protein source for growing goats by smallholder farmers. Livestock. Res. Rural. Dev. 10(3):15-23.

[14] Nigussie, Z. and G. Alemayehu. 2013. Sesbania sesban (L.) Merrill: Potential uses of an underutilized multipurpose tree in Ethiopia. Afr. J. Plant Sci. 7(10):468-475.

[15] Otte, M.J. 2013. Enhancing animal agriculture in developing countries through international and regional collaborations. The 4th International Conference on Sustainable Animal Agriculture for Developing Countries. Pp. 14-18.

[16] Rahman, MZ., MA. Akbar, MA. Hossain, MY. Ali. 2015. Effect of tree forage supplementation on growth performance of goats. Asian J. Med. Biol. Res. 1(2):209-215.

[17] Shahudin, MS., AAA Ghani, M. Zamri-Saad, AB. Zuki, FFJ Abdullah, H. Wahid, MSA. Roslee, H. Hamzah, HA. Hassim. 2016. The Effect of Different Feed Formulation Based on Local Feed Resource on Performance and Stress Parameter in Breeder Goat. In Proceedings of International Seminar on Livestock Production and Veterinary Technology. Pp. 291-299.

[18] Wadhwa, M. and MPS. Bakshi. 2013. Utilization of fruit and vegetable wastes as livestock feed and as substrates for generation of other value-added products. FAO Regional Office for Asia and the Pacific Publication. 4:6-8.

[19] Yami, A. 2008. Nutrition and feeding of sheep and Goats. In Sheep and Goat Production Handbook for Ethiopia. Alemu Yami and R.C. Merkel (Editors). Pp. 110-167.

[20] Zahari, MW. and HK. Wong. 2009. Research and development on animal feed in Malaysia. WARTAZAO Indonesian Bulletin of Animal and Veterinary Sciences. 19(4):172-179.