# IN VITRO FERMENTATION OF GOAT RUMENT FED WITH FORAGE COMPLETE RATION BASED ON PALM PLANTATION WASTE

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**Abstract**

Palm oil plantation in Kalimantan has potency as a carrying capacity in the development of livestock, as a source of forage feed source of ruminant livestock. The purpose of this research was to know the digestibility of *in vitro* complete forage wafer. The method used in this study was Completely Randomized Design consisting of 5 treatments and 4 replications so that there were 20 units of experiments: PT0 = 50% field grass + 50% Legume. PT1 = 50% palm plantation waste + 50% legume; PT2 = 50% palm plantation waste + 50% grass ; PT3 = 50% Waste Palm Plantation + 25% Legume + 25% Grass Field. PT4 = 100% Palm Waste. Parameters evaluated were physical properties, wafer quality and characteristics of fermentation digestion digestibility of local goat rument fluid. The results showed that the utilization of palm plantation waste with wafer technology had water content, absorbency, density and good texture on PT4 treatment which was 50% of palm plantation waste, 25% lugume and 25% field grass, and also had good nutrition.

**Keywords**: Waste, palatability, palm, wafer

## BACKGROUND

Today the growth of oil palm plantations in Indonesia is very rapid, in 2013 Indonesia's CPO production increased by 6.7% from 22 million tons to 23.30 million tons (Litbang, 2014). South Kalimantan has considerable potential in palm oil development, currently the extent of coconut is around 1,557,752 ha, as indicated by the development of oil palm plantations in some districts (BPS Kalsel, 2014). The large number of oil palm plantations will certainly generate considerable waste. Waste palm plantations can be empty bunches, midribs, leaves, sludge, palm kernel meal (palm kernel meal) and shell, this palm waste has not been optimally utilized. In Sumatra, especially in palembang province, palm oil wastes have been used by residents around the plant for livestock feed (Fariani et al, 2013) and in the new stages trying Kalteng (Utomo and Wijaya, 2012). Oil palm plantation company in South Kalimantan Province has not yet utilized this palm oil plantation. Therefore, it needs a mutually beneficial cooperation so that the surrounding community can benefit from the existence of the oil palm plantation.

Potential animal feed from palm oil waste is palm kernel cake, palm sludge, oil palm leaves derived from pruning of palm fronds and midrib leaves. From a palms tree palm frond leaves can be produced 3.333 kg of fresh palm leaves with dry matter content reached 35%, as well as palm leaves. (Biyatmoko, 2013). This by-product of oil palm plantations can not be given directly to livestock because it has limiting factors (Rostini et al., 2017). The use of palm waste for livestock feed needs to use appropriate processing technology to be digested by livestock. Rostini and Jaelani (2011). One technology that can be used in palm waste processing is by making a complete wafer. Wafer is one form of animal feed which is a modification of cube form, in the process of making the process of mixing (homogenization), compaction with pressure and heating in a certain temperature. The raw materials used consisted of fiber sources of forage and concentrates with compositions prepared according to the nutrient requirements of livestock and in the manufacturing process compacted with a pressure of 12 kg / cm2 and heating at 120 ° C for 10 minutes (Retnani et al, 2013). The complete nutritional quality (complete ration wafer) of food composition is made to resemble feed forage composition with the addition of vegetable, animal, animal and non-protein nitrogen source of protein, so it is expected to increase its palatability as ruminant feed (Basymeleh, 2009).

Complete feed wafers are animal feeds that have dimensions (length, width, and height) with compositions consisting of several identical or uniform fibers (ASAE, 1994). Feed wafer from vegetable waste is an alternative feed to replace forage during the dry season. The form of feed is made by utilizing vegetable waste, so the price is cheap. Feed wafers are made using pressing machines with the help of heat and pressure. The composition of food substances is made preferable to livestock (palatabel) and can be given with maximum and can overcome the scarcity of forage in the dry season. Thus waste oil palm plantations can be given to livestock. This can reduce the impact of environmental pollution and can increase the supply of animal feed.

The purpose of this research is to know the effect of Feed use in the form of wafer based on palm oil plantation to the digestibility of invitro in goats.

## METHODS

### Trial Equipment

The equipment used in this research is grinding machine (hammer mill swing type), hydraulic press machine (temperature 1500C, pressure 200-300 kg / cm3 for 20 minutes), Aw meter, thermohigrometer, mixing bucket and plastic bag.

### The raw material of the complete forage wafer

The wafer raw materials used in this study contain corn, bran, cassava flour, field grass, legumes, palm stem, leaves, palm kernel cake, urea, minerals and molasses. Waste of oil palm plantations obtained from the palm oil plantations in Gunung Kupang, city Banjarbaru

The method of making a complete forage wafer in the study begins with oil palm leaves in peel either manually or using the machine, then in the mix until soft. The process of making complete wafer forage based on palm oil plantation is made by: after palm stem is peeled, then done by chooper enumeration until soft shape like fiber begutu also with palm leaf. Dry with sun or dryer Try to dry when the material is turned back for maximum drying and evenly, during the time 5 - 8 hours until the water content reaches 15-17%. Then mix the

core of palm kernel, maize, urea, bran, cassava flour, urea, vitamins and molasses until well blended, Complete wafer nutritional content tailored to the nutritional needs of local goat age of one year. Goat nutritional requirements refer to NRC (2004), 400 gram mixed material is inserted in a 20 x 20 x 1.5 cm mold, after which the wafer sheeting for 24 hours, is left in the open air (room temperature). Then the wafer product produced before it is evaluated its quality is first aerated for drying, after which the sample is taken aseptically and taken to the laboratory for analysis. Analysis of wafer quality is done by looking at digestion invitro consisting of: physical properties, nutritional content and characteristics of digestion digestro Fermentation.

**Formulations Wafer Forage Complete**

The complete forage wafer formultion is prepared to meet the needs of goats for growth of 1-2 years of age, Composition of complete forage wafers presented in Table 1.

Table 1. Complete Forage Complete Wafer Components (%)

| *Feed ingredients* | **PT0** | **PT1** | **PT2** | **PT3** | **PT4** |
|---|---|---|---|---|---|
| *Field Grass* | 30 | 30 | | 7,5 | |
| *Leguminose* | 30 | 0 | 30 | 7,5 | |
| *Palm Laves* | | 12 | 12 | 18 | 24 |
| *Palm stem* | | 12 | 12 | 18 | 24 |
| *Rice palm kemel* | | 6 | 6 | 9 | 12 |
| *Rice bran* | 13,2 | 13,2 | 13,2 | 13,2 | 13,2 |
| *Flour cassava* | 7,5 | 7,5 | 7,5 | 7,5 | 7,5 |
| *Corn* | 13,3 | 13,3 | 13,3 | 13,3 | 13,3 |
| Urea | 0,5 | 0,5 | 0,5 | 0,5 | 0,5 |
| Vitamin | 0,5 | 0,5 | 0,5 | 0,5 | 0,5 |
| Molasses | 5 | 5 | 5 | 5 | 5 |
| Amoun | 100 | 100 | 100 | 100 | 100 |

The data obtained were analyzed using Fingerprint. If there is a real difference then proceed with Orthogonal Contrast Test (Steel and Terry, 1991). The data obtained were analyzed using Fingerprint. If there is a real difference then proceed with Orthogonal Contrast Test (Steel and Terry, 1991).

## RESULTS AND DISCUSSION

### Physical properties and characteristics of complete forage wafers

The physical properties and characteristics of the wafers observed are the color, aroma, density and texture of the wafer. The physical properties of wafers are presented in Table 2.

Table 2. Average physical properties and characteristics of complete forage wafers

| Variabels | **PT0** | **PT1** | **PT2** | **PT3** | **PT4** |
|---|---|---|---|---|---|
| *Color* | chocolate | Chocolate | chocolate | chocolate | chocolate |
| Aroma | The smell of forage | The smell of forage | The smell of forage | The smell of forage | The smell of forage |
| Particle size (mm) | 1,6 | 1,6 | 1,6 | 1,6 | 1,6 |
| Density(g/cm3) | 0,65 | 0,68 | 0,72 | 0,75 | 0,63 |
| Absorption (%) | 105,54 | 107,65 | 108,77 | 105,66 | 104,54 |

Information PT0 = 50% field grass + 50% Legume. PT1 = 50% Waste palm plantation + 50% legume . PT2 = 50% Waste palm plantation + 50% grass field. PT3 = 50% Waste Palm Plantation + 25% Legume + 25% Grass Field. PT4 = 100% Palm Waste

The wafer density level indicates the quality of the wafer's physical form, where in this study the wafer density did not show significant differences (P <0.05) between treatments, but there was an increasing trend, where more use of palm oil plantation wastes the higher the density of the wafer Resulting in PT3 wafer density of 0.75 g / cm3 and the lowest in PT4 is 0.63 g / cm3. The results of this study are still in line with the results of research Noviagama (2002) produces wafer density level of 0.515-0.736 g / cm3 by using cappers gaplek. While Jayusmar et al., (2002), pointed out that wafers that have a high density can improve the efficiency of storage space and facilitate the transport and shocks during transport and can be durable.

Water absorption is the ability of the material to absorb water around it to bind to the particles of materials used. The results of this study indicate that waste-based wafers have a water absorption rate ranging from 104.54% to 108.77%, this result does not indicate a significant difference between treatments but if the use of waste oil palm is improved then there is a tendency for increased water absorption. This indicates that the more fiber used will result in the expansion of wafer particles and weaken the bonds between particles, so that the wafer particles can enlarge themselves from the pressure experienced at the time of the sealing, resulting in an increase in the value of water absorption. Siregar (2005) points out that there is a positive relationship between water absorption and fiber content of wafer preparation, while Trisyulianti et al. (2003) suggests that water absorption is inversely related to wafer density where the higher water absorption density is lower.

**Composition Chemistry Complete Wafer Forage**

The complete chemical composition of the green wafer is presented in Table 3. Crude protein content (PK) treatment with mean and standard deviation of 12.06 ± 060%. This content has met the requirements required by the NRC (2004) of 12% for growth-growth goats.

Table 3. Wafer nutrient content based on palm oil waste

| Nutrient content | PT0 | PT1 | PT2 | PT3 | PT4 |
|---|---|---|---|---|---|
| Dry matter (%) | 85,01 | 85,43 | 85,64 | 86,56 | 85,43 |
| Ash(%) | 8,05[b] | 8,16[b] | 7,43[a] | 9,89[c] | 9,12[c] |
| Crude Protein (%) | 11,13[a] | 12,54[b] | 11,98[a] | 12,64[b] | 12,01[a] |
| Crude Fiber (%) | 26,72[b] | 27,12[c] | 28,88[c] | 25,61[b] | 25,86[a] |
| Crude fat(%) | 0,43 | 0,65 | 0,32 | 0,67 | 0,53 |
| NFE | 32,15[a] | 35,32[b] | 31,64[a] | 44,03[c] | 40,54[c] |
| NDF(%) | 75,82 | 74,54 | 73,56 | 75,65 | 74,98 |
| ADF(%) | 54,23 | 53,56 | 52,87 | 54,76 | 55,72 |
| Ca(%) | 0,21 | 0,6 | 0,64 | 0,65 | 0,64 |
| P(%) | 0,12 | 0,24 | 0,32 | 0,34 | 0,32 |

Information PT0 = 50% field grass + 50% Legume. PT1 = 50% Waste palm plantation + 50% legume . PT2 = 50% Waste palm plantation + 50% grass field. PT3 = 50% Waste Palm Plantation + 25% Legume + 25% Grass Field. PT4 = 100% Palm Waste

The content of complete feed wafer protein showed a significant difference at the level (P <0.05) where in the treatment of PT3 had protein content of 12.64% while in the treatment of PT0 (without the addition of waste oil palm plantation yields crude protein of 11.13%, it is suspected material A mixture of palm oil plant waste can increase the wafer protein content, despite evaporation due to the impregnation but the resulting wafer remains constant.

The fiber of the complete feed wafer showed a significant difference between treatments (P <0.05) where the treatment of PT3 had a crude fiber content of 25.61% while the highest on the PT2 treatment was 28.88%, this is because in this treatment the wafer material used only Palm oil plantation wastes, but the results of this study are still within the tolerable range of crude fiber content for ruminants.

**Characteristics Fermented digestion invitro of Goat kacang**

Characteristics of fermentation of goat feed (Table 4) given complete wafer forage based on palm oil plant waste in vitro with rumen goat fluid were mostly not significantly different except for dry matter digestibility (KCBK) and organic matter digestibility (KCBO)

which differed significantly (P <0.05). It appears that PT3 shows KCBK and KCBO which are significantly higher than PT0. This means that wafers with mixed waste oil palm plantations increase the digestibility of both dry matter (62%) and organic matter (64.63%). In vitro, the digestibility of BK (59.02- 62.0%) with acetate concentration (C2), propionate (C3), and butyricate (C4) with total VFA (42.24-45.62 mM).

Table 4. Characteristics of fermentation digestibility of wastewater invitro based wafer for waste Palm plantations on goat kacang

| Variabel | PT0 | PT1 | PT2 | PT3 | PT4 |
|---|---|---|---|---|---|
| Dry matter (%) | 59.52$^{a}$ ± | 60.26$^{a}$ ± 1.90 | 60.77$^{a}$ ± | 62.00$^{b}$ ± | 60,65$^{a}$±12 |
| Organik matter | 60.12$^{a}$ ± | 61.54$^{a}$ ± 3.07 | 62.42$^{ab}$ ± | 64.63$^{b}$ ± | 61.85$^{a}$±1.64 |
| NH3 (mM) | 11.26 ± | 10.28 ± 3.82 | 9.31 ± 3.75 | 8.73 ± 3.16 | 8,23±2.54 |
| pH | 6.69 ± | 6.70 ± 0.08 | 6.71 ± 0.04 | 6.72 ± 0.04 | 6,54±0.04 |
| VFA total (mM) | 42.24$^{a}$ ± | 43.86$^{ab}$ ± | 44.42$^{b}$ ± | 45.62$^{b}$ | 43,89$^{ab}$±10,7 |
| Asetat (A), % | 62.13 ± | 63.68 ± 3.24 | 65.62 ± | 66,12 ± | 65,54±24 |
| Propionat (P), % | 20.62 ± | 19.25 ± 2.43 | 18.25 ± | 18.14 ± | 19,45±3.97 |
| Butirat (B), % | 11.76 ± | 11.84 ± 2.23 | 11.42 ± | 11.42 ± | 10,67±3,2 |
| Iso Butirat (B),% | 1.23 ± | 1.11 ± 0.64 | 1.08 ± 0.42 | 1.06 ± 0.68 | 1,23±0.98 |
| Valerat (V), % | 1.64 ± | 1.76 ± 0.56 | 1.72 ± 0.86 | 1.42 ± 0.85 | 1,47±0.62 |
| IsoValerat , % | 2.76 ± | 2.48 ± 0.68 | 2.54 ± 0.38 | 2.56 ± 0.69 | 2,12±0.56 |

Information PT0 = 50% field grass + 50% Legume. PT1 = 50% Waste palm plantation + 50% legume . PT2 = 50% Waste palm plantation + 50% grass field. PT3 = 50% Waste Palm Plantation + 25% Legume + 25% Grass Field. PT4 = 100% Palm Waste

Compared with the above results data showed higher KCBK and KCBO, lower total VFA, but partial VFA percentage was higher. Schmidely et al. (2005) reported that goat rumen fermentation with 10% soybean waste plus NaHCO3 produced the highest total VFA (63.8 mM), higher than the highest total VFA on PT3 (45.27 mM). The partial Volatile Fatty Acid (VFA), which consists of acetate, propionate, isobutyrate, valerate, and isovalerate, all higher in all study rations except in PT3 for isobutyrate and all butyrates.

N-NH3 concentrations decreased from basal or pT0 (11.26 mM) to 8.73 mM in PT4; While concentrations in PT1 and PT3 were respectively 10.28 mM and 9.31 mM in goat rumen fermentation. The NH3 concentration and pH (average 6.7) in these four rations were higher than NH3 (8.5- 9.6) and pH (6.2) in goat rumen fermentation with complete green wafers with or without NaHCO3 (Schmidely et al., 2005).

## CONCLUSION

The results showed that palm oil waste can be utilized as forages of livestock feed through complete wafer forage technology that has good quality and has a high invitro digestibility.

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