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THE INFLUENCE OF PRESSING TREATMENT AND DIFFERENT DEFOLIATION TIME OF KING GRASS TO VOLATILE FATTY ACIDS AND AMMONIA PRODUCTION *IN VITRO*

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Abstract

The objectives of the study were to investigate the production of volatile fatty acids (VFA) and ammonia (NH_3) *in vitro* of King Grass under unpressed (P0) and pressed (P1) condition and different time of defoliation (30, 45 and 60 days). Split plot designs with three replications were used in this experiment. The result showed that defoliation time significantly influenced ($P<0.05$) to VFA and NH_3 productions. There were no interactions between treatments. Defoliation time (30 days) gave the highest VFA and NH_3 productions.

Key words: King Grass, Defoliation time, Pressing treatment, VFA and NH_3 productions

Introduction

The increasing of animal population needed to be fulfilled by a cheap feedstuff. In tropical area, problem which often being faced in feed supply was fluctuation of forage production, particularly in dry season where forage was very limited. This situation motivated to supply forage in dry season so that feed supplying could be supplied continuously along the year. One alternative in feed supplying was the making of complete feed. Pressing treatment of forage was an initial process in making of complete feed. Pressing treatment enhanced drying process. In addition, pressing treatment could prohibit over heating in drying process because its high moisture content in forage. Percentage of water that came out during pressing treatment depended on the lifespan of forage. Hence, it needed an evaluation of defoliation time of King Grass that pressed and unpressed to its nutrient quality. The objectives of the study were to investigate VFA and ammonia productions *in vitro*. Benefits of the study were to inform the best defoliation time of King Grass and impact of pressing treatment to nutrient quality of King Grass.

King Grass (*Pennisetum hybrid*) is a crossing grass between *Pennisetum purpureum* and *Pennisetum thypoides* (Budiman and Djamal, 1994). King Grass is highly tolerant with planting area; however, King Grass is intolerant in flooded area (Siregar, 1988). Chemical composition of King Grass according to Siregar (1994)

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based on 100% DM are 8.6% ash, 13.5% crude protein, 3.5% ether extract, 34.1% crude fibre and 30.3% nitrogen-free extract.

Defoliation is a taking up activity of crop parts above the ground, by human activity or grazing animal (Susetyo *et al.*, 1966). Defoliation is better being done in growth phase because the plants still have the chance to bud and there are rich of nutrient, which needed by animal (Yamada, 1975 cited by Kristanto and Karno, 1991). Protein content of forage decreases along with increasing of defoliation time (Rahmadi *et al.*, 2001); contrary, there are increasing in crude fibre (Crowder and Chheda, 1982). Many factors have to be noticed due to defoliation to get optimal production with good quality of forage are: a) plant age, b) defoliation frequency, and c) the height of cutting (Yamada, 1975 cited by Kristanto and Karno, 1991).

Pressing treatment is an action to make something big in volume into compact in shape by pressing machine (Utomo, 1999). Pressing treatment can cause the loss of water-soluble carbohydrate or nitrogen-free extract. Almost all of sucrose and dextrose are loss in pressing; moreover, starch and dextrin are decreasing in along time. The objectives of pressing are: a) easily to handle, b) easily to store, c) decrease transport cost, and d) to protect damage of forage caused by weather.

Materials and Methods

Study was conducted in Faculty of Animal Science Diponegoro University, Semarang. Sample analysis was conducted in Feed Science Laboratory, Nutrition and Animal Feed Science Department, Faculty of Animal Science, Diponegoro University.

Materials used in this study were King Grass forage with defoliation time of 30, 45 and 60 days (D1, D2 and D3). Reagents used in sample analysis were saturated Na_2CO_3, 1% phenolphthalein indicator, mixed indicator of methyl red and bromcressol green, and rumen liquid. Equipments used were chopper, pressing machine, grinder, Sartorius analytical balance, VFA distillation tool set and Conway tool set.

Study was conducted in three series activities, i.e. planting of King Grass using slip of King Grass stalk, unpressed (P0) and pressed (P1) of King Grass forage at different defoliation time, preparation and sample analysis. Every treatment had 3 replications. VFA and NH_3 were measured according to Harris (1970).

Split plot designs with three replications were used in this experiment. Defoliation time at 30, 45 and 60 days (D1, D2 and D3) were the main plot. Unpressed (P0) and pressed (P1) were the subplots. Data analysed with analysis of variance continued with Duncan's multiple range tests.

Results and Discussion

Table 1 showed VFA and NH_3 production of King Grass *in vitro* affected by pressing treatment and defoliation time. Statistical computation showed that defoliation time was significantly influenced ($P<0.01$) VFA and NH_3 production. There were no significant difference in pressing factor, both for VFA and NH_3 production. There were no interaction between treatment both for VFA and NH_3 production.

Table 1. VFA and NH_3 production of King Grass *in vitro*

Treatment		P0	P1	Average
VFA (mM)	D1	133.333	130.000	131.665[a]
	D2	120.000	113.333	116.666[ab]
	D3	110.000	106.667	108.334[b]
	Average	121.111	116.666	118.888
NH_3 (mM)	D1	6.692	6.310	6.501[a]
	D2	6.425	6.142	6.283[a]
	D3	5.731	5.262	5.496[b]
	Average	6.282	5.904	6.093

[a, b] Value with different superscripts within column differ significantly ($P<0.01$)

Volatile Fatty Acids production

Average of VFA production at 30, 45 and 60 days defoliation time were 131.665, 116.666 and 108.334 mM, respectively. All average of VFA production was within the range to support optimal protein microbial synthesis. Sutardi *et al.* (1983) stated that VFA concentration which being needed to support protein microbial synthesis within the range 80 – 160 mM.

VFA production of King Grass *in vitro* in 30 days defoliation time was higher than 45 and 60 days defoliation time. VFA production of King Grass decreased along with increasing defoliation time. More older the plants caused water-soluble carbohydrate proportion or nitrogen-free extract decreased and increased hemicellulose proportion. According to Tillman *et al.* (1998), along with the lifespan of the plants, hemicellulose proportion increased, however water soluble carbohydrate proportion decreased. Nitrogen-free extract will be quickly fermented in the rumen, which will increase the amount of fermented substrate per unit time, so it will increase VFA concentration. A large number of VFA is the end product of carbohydrate fermentation by microorganism (France and Siddon, 1993). Increasing of defoliation time caused the decreasing of water-soluble carbohydrate in King Grass, which affects the decreasing of VFA production.

VFA production decreased along with decreasing in *in vitro* organic matter digestibility. Organic matter digestibility affected to VFA production of King Grass.

Hume *et al.* (1970) reported that decreasing in organic matter digestibility would decrease VFA concentration. Data on the same study showed that average of *in vitro* organic matter digestibility of King Grass at 30, 45 and 60 defoliation time were 51.269, 48.005 and 46.715%, respectively. Degradation product of component, particularly carbohydrate is VFA, so the decreasing of organic matter digestibility will decrease VFA concentration. According to Church (1988), digestibility would increase if soluble substance like nitrogen-free extract and protein increased and insoluble substance decreased. Based on proximate analysis, crude fibre of King Grass increased along with defoliation time. Schneider and Flatt (1975) stated that maturity phase maybe affect forage digestibility because there was chemical composition change, in old plants the crude fibre was increased and affected to its digestibility compared to the young plants. Crowder and Chheda (1982) stated that increasing in crude fibre was caused by increasing the weight of cell wall and decreasing the weight of cell content in plants. In old plants, organic matter digestibility decreases because there were chemical composition changes particularly increasing of crude fibre.

Average of VFA production in P1 was lower than P0. This decreasing was caused by the loss of soluble nutrients during pressing treatment. According to Utomo (1999), pressing treatment can cause the loss of water-soluble carbohydrate or nitrogen-free extract. The objective of pressing was to decrease moisture content so that enhanced drying process. The more water came out during pressing, water-soluble carbohydrate or nitrogen-free extract proportion more decrease and crude fibre more increase. The loss of nitrogen-free extract affected the decreasing of VFA production.

NH_3 production

Averages of NH3 production were 6.501, 6.283 and 5.496 mM in 30, 45 and 60 days defoliation time, respectively. All average of NH_3 production was optimal to support protein microbial synthesis. According to Sutardi *et al.* (1983), biosynthesis of protein microbial will be maximum in concentration of rumen ammonia between the ranges 3.57 – 7.14 mM. Increasing of King Grass defoliation time affected the decreasing of ammonia production. This was caused by feed protein content in feedstuff and protein degradability. Protein, which consumed by ruminants, would pass two possibilities, i.e. by-passed from degradation and degraded by rumen microbial. Protein, which endures to rumen microbial degradation, will lead to post rumen digestive tract. However, degradable protein would be changed into ammonia.

Crude protein content decreased along with the lifespan of King Grass (Rahmadi *et al.*, 2001). According to Sutrisno (1983), crude protein content of forage generally decreased along with increasing of defoliation time, contrary to its crude fibre content. Ammonia was produced from protein or non-protein nitrogen (Maynard and Loosli, 1969). Crude protein content of King Grass in the same study at 30, 45 and

60 days defoliation time was 10.707, 10.145 and 9.158%, respectively. The decreasing of crude protein production would cause the decreasing of King Grass ammonia production *in vitro*. Protein, which linked to plants cell wall, affected protein more difficult to be digested. As the consequence, ammonia production decreased. Organic matter digestibility could be used as one of the indicator to understand the degradability of protein. Data on the same study showed that average of *in vitro* organic matter digestibility of King Grass at 30, 45 and 60 defoliation time were 51.269, 48.005 and 46.715%, respectively. The data showed that increasing of defoliation time caused the decreasing of digestibility. The higher crude fibre of feedstuff tended to decrease its digestibility. Decreasing of organic matter digestibility showed that protein degradability decreased and produced low ammonia. Low degradability of protein caused low ammonia concentration in the rumen (Nolan, 1993).

Average of ammonia production of King Grass in P1 was lower than P0. This decreasing was caused by the decreasing of crude protein content of King Grass during pressing treatment. Pressing treatment affected the loss of nutrient content along with water came out. Soluble protein in water lost along with water came out during pressing treatment. Result of proximate analysis showed that crude protein content of pressed King Grass was lower than unpressed. Decreasing of crude protein in King Grass would cause the decreasing of King Grass ammonia production *in vitro*.

Conclusion

VFA and ammonia production decreased along with the increasing of King Grass defoliation time. Pressing treatment was not significantly influenced VFA and ammonia production of King Grass. VFA and ammonia production of King Grass with un pressed treatment was higher than pressed treatment. VFA and ammonia production at all defoliation time was not change during pressing treatment.

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