Evaluating the Digestibility of Ammonia Fermented (Amofer) Corn Cob Using Different Levels of M21 Decomposer and Urea (In Vitro Study)

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Abstract. This research aimed to evaluate the addition of M21 Decomposer (MD) and urea (U) on the Dry matter digestibility (DMD) and Organic matter digestibility (OMD) in vitro. There were five treatments and five replicates. The treatments in this study were the addition of MD and U at different levels. namely R0 = Corn cob without amofer/control; R1 = Amofer Corn cob plus 0.04% MD+3% U; R2 = Amofer Corn cob plus 0.06% MD+3% U; R3 = Amofer Corn cob plus 0.04% MD+5% U; and R4 = Amofer Corn cob plus 0.06% MD+5% U. The obtained data were subjected to Analysis of Variance and continued by an Orthogonal Contrast. The result showed that the treatments significantly affected (P<0.05) both DMD and OMD digestibility. The digestibility of amofer corncob was higher than the non-amofer that exhibited 17.982±2.4409% DMD and 26.024±3.009% OMD. The highest DMD and OMD digestibility was observed in R4, i.e., 24.655±4.858% and 34.276±5.176%.respectively. In conclusion, the best level in the incorporating MD and U is at MD 0.06% and U 5% could improve DMD by 6.673% and OMD by 8.252%.

Keywords: amofer, corn cob, digestibility, dry matter, organic matter

Introduction

Corn cob is a part of corn plant that becomes an agricultural waste. Meanwhile, corn cob is the potential feed for livestock, especially ruminants. Cornfields cover an area of 52.8054 ha across Central Java province, producing 3,212,391 tons in 2015 (Central Java BPS, 2018) and keeps increasing in the past five years. As a result, corn cobs are vastly available for feed, but the quality is poor. Low digestibility and protein content contribute to the low-quality corn cob, so it is crucial to perform advanced treatments to the cobs before feeding.

Ammoniation and fermentation are two combined techniques in feed processing that could improve the quality of corn cob as animal feed. Ammonia works in detaching lignin-cellulose bound and providing N source for the growth of microbe. Meanwhile, fermentation improves digestibility and crude protein in the corn cob (Prastyawan et al., 2012). Ammoniation may use urea as the source of N,
and fermentation may use a commercial starter (M21 Decomposer) as the source of microbe. However, the level of use of M21 Decomposer and urea in the amofer process still needs to be evaluated to determine its effect on digestibility. This study aims to evaluate the additional level of M21 Decomposer and urea and their effect on the digestibility of both dry matter and organic matter.

Materials and Methods
The materials consisted of (1) corn cobs from harvested and chopped hybrid yellow corn; (2) M21 Decomposer containing various microbes including Pseudomonas, Actinomycetes, Lactobacillus, Acetobacter, Trichoderma and Rhizobium; (3) N content in urea; and (4) water. The study conducted an in vitro experiment using a method by Tilley and Terry (1963) in a Completely Randomized Design, assigning five treatments, and five replicates. The treatments were R0 = Corn cob without amofer/control; R1 = Amofer Corn cob plus 0.04% MD + 3% U; R2 = Amofer Corn cob plus 0.06% MD + 3% U; R3 = Amofer Corn cob plus 0.04% MD + 5% U; and R4 = Amofer Corn cob plus 0.06% MD + 5% U. The measured variables included Dry matter digestibility (DMD) and Organic matter digestibility (OMD). The obtained data were subjected to analysis of variance (ANOVA) to evaluate the effect of treatments on the measured variables, continued by an Orthogonal Contrast test.

Results and Discussion
Dry matter digestibility and Organic matter digestibility (Table 1) showed that the ammonia fermentation (amofer) using M21 Decomposer and urea on the corn cobs could increase the DMD and OMD. The data illustrated that DMD and OMD of amofer corn cobs in the treatment R1, R2, R3, and R4 were higher (P<0.05) than those of control/without amofer treatment (R0). Furthermore, the analysis showed that the highest DMD and OMD were obtained from the amofer corn cobs in treatments R4 with an additional 0.06% M21 Decomposer and 5% urea. Meanwhile, DMD and OMD across treatments R1, R2, and R3 were not significantly different (P>0.05). It demonstrates that incorporating M21 Decomposer and Urea could increase DMD and OMD.

The effect of treatments on dry matter digestibility
The result of DMD analysis showed that treatment R0 was significantly different (P<0.05) from R1, R2, R3, and R4. Incorporating M21 Decomposer and Urea could increase the corn cobs DMD due to the loose lignin-cellulose bound as a result of the ammoniation and fermentation process that pre-digest the complex compounds outside the rumen with the help of microorganism in the M21 Decomposer. It was in line with Prastyawan et al. (2012) that the DMD of corn cobs treated with ammonia fermentation would increase as the level of starter improved.

The result of DMD analysis on treatment R4 showed a highly significant difference (P<0.01) from that of treatment R3. Dry matter digestibility of the R4 treatment increased by 6.673% compared to untreated corn cobs (R0). Dry matter digestibility represents the total digestible nutrition by the ruminal microbes. Therefore, the higher the DMD, the more nutrients digested by the ruminal microbe. The highest additional level of M21 Decomposer and urea was in R4 of all treatments. As a result, R4 had the highest digestibility of amofer corn cobs. Yulistiani et al. (2011) stated that incorporating 3% urea into the corn cobs could increase dry matter digestibility by 31% and organic matter digestibility by 43%.
Table 1. In vitro digestibility

| Variable | DMD (%) | OMD (%) |
|----------|---------|---------|
| F count  | 4.020 * | 4.179 * |
| F tab 0.05 | 2.866 | 2.866 |

| R0          | 17.982 ± 2.409 | 26.024 ± 3.009 |
| R1          | 21.277 ± 1.561 | 30.91 ± 2.818  |
| R2          | 20.483 ± 2.928 | 28.213 ± 3.066 |
| R3          | 18.777 ± 1.299 | 29.527 ± 1.954 |
| R4          | 24.655 ± 4.858 | 34.276 ± 5.176 |

| Contrast | F hit | F hit |
|----------|-------|-------|
| F table 0.05 | 4.351 | 4.351 |
| R0 vs R1,R2,R3,R4 | 5.223 * | 7.7740 * |
| R1 vs R2,R3,R4 | 0.000 | 0.0187 |
| R2 vs R3,R4 | 0.602 | 3.9786 |
| R3 vs R4 | 10.256 ** | 4.9452 * |
| Average R1,R2,R3,R4 | 21.298 | 30.731 |
| Average R2,R3,R4 | 21.305 | 30.672 |
| Average R3,R4 | 21.716 | 31.901 |

Note: * = significant effect (P<0.05); ** = highly significant effect (P<0.01)

Table 2. Dry matter and Crude Fiber of amofer corn cob

| Treatments | DM(%) | CF (%) |
|------------|-------|--------|
| R0         | 96.33 | 30.95  |
| R1         | 94.80 | 31.79  |
| R2         | 94.83 | 29.35  |
| R3         | 93.65 | 30.17  |
| R4         | 93.06 | 28.97  |
| F count    | 6.65**| 54.31**|
| F tab 0.05 | 2.87  | 2.87   |

Note: ** = highly significant effect (P<0.01)

The content of microorganism present in M21 Decomposer is able to produce enzymes that degrade compounds in corn cobs. Actynomycetes as one of the microorganisms contained in M21 Decomposer are capable of producing lignocellulolytic enzymes that can degrade lignocellulose (Saini et al., 2015). Another microorganism in M21 Decomposer, Pseudomonas, is able to produce potease, amylase and lipase enzymes that can degrade proteins, carbohydrates and other organic matter into CO$_2$, ammonia gas and other simpler compounds (Har dhianto, 2010).

The effect of treatments on the organic matter digestibility

The result of OMD analysis showed that treatment R0 was significantly different (P<0.05) from that of R1, R2, R3, and R4. High DMD in amofer corn cobs was relevant to that of OMD. Similarly, Prastyawan et al. (2012) stated that organic matter and dry matter digestibility had the same pattern. The higher OMD of amofer corn cobs was because of the increased level of organic matter in the corn cobs. Fitria et al. (2019) reported that corn cobs treated with ammonia fermentation using M21 Decomposer could increase the level of organic matter in the corn cobs.

The OMD of treatment R4 is significantly higher (P<0.05) from that of R3. The digestibility of organic matter in the R4 treatment increased by 8.252% compared to the untreated corn cobs (R0). It was because of the low crude fiber in amofer corn cob sin R4. It is evident from the
proximate analysis (Table 2) that the crude fiber of treatment R₄ was the lowest of other treatments. Additionally, high crude fiber could decrease the digestibility of a feedstuff (Yulistiani et al., 2017). Crude fiber is a complex carbohydrate that is difficult to digest so the lower crude fiber in a feed results in higher digestibility and vice versa. The decreased crude fiber in the amofer corn cobs due to microbial fermentation could increase the degradation potential of a compound in feedstuff (Riswara et al., 2018).

Conclusions

The treatments in this study significantly affected the digestibility of both dry matter and organic matter of corn cobs treated with ammonia fermentation consisted of 0.06% M21 Decomposer and 5% urea. This study reported 24.655% dry matter digestibility and 34.276% organic matter digestibility.

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