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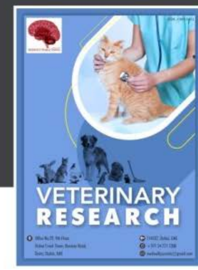

# Impact of Feed Agricultural Waste on Performa Product and Nutrient Digestibility Through *In-Vivo*

[1]Nurina Rahmawati, [1]Ertika Fitri Lisnanti, [2]Muladno, [2]Afton Atabany, [1]Didik Rudiono and [1]Amiril Mukmin

[1]*Animal Husbandry Study Program, Faculty of Agriculture, University of Islam Kadiri, Kadiri, Indonesia*

[2]*Department of Animal Production and Technology, Faculty of Animal Science, Bogor Agricultural University, Bogor, Indonesia*

**Key words:** Agricultural waste, performa production, nutrient digestibility, *in-vivo*, single, livestock, needs

**Corresponding Author:**
Didik Rudiono
*Animal Husbandry Study Program, Faculty of Agriculture, University of Islam Kadiri, Kadiri, Indonesia*

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**Abstract:** This study was to determine the effect of agricultural waste-based feeding on performing production and nutrient digestibility of beef cattle in the form of four types divided into four treatments namely, P-1, P-2, P-3 and P-4. The material used is bulls amounted to 28 head initial body weight of cattle ranging from 350-400 kg with Simental and Limousine breeds; cow faces samples were 28 samples from four feed treatments and seven replications. Variables observed were performing production including feed consumption, daily body weight gain, feed conversion, feed efficiency, feed cost per profit and income over feed cost and feed nutrient digestibility. The results of the study of feed from agricultural waste have a significant effect ($p<0.05$) on the consumption (10.20±0.43 kg/head/day). Dry matter digestibility (75.48±1.46%) and organic matter digestibility (69.14±1.21%). No significantly effect ($p>0.05$) on daily body weight increase, feed conversion ratio, feed efficiency, feed cost per gain, income over feed cost of beef cattle. P-1 is the best treatment to feed consumption, dry matter dan organic matter digestibility of beef cattle.

## INTRODUCTION

Community needs for animal protein, especially beef, continues to increase. Animal Husbandry and Animal Health Statistics 2019, showing national meat consumption per capita per day is 2015 (2.47 g), 2016 (2.68 g, 2017 (3.13 g), 2018 (3.35 g) and 2019 (4.20 g). Indicated by the increasing population of beef cattle every year. The average population of beef cattle in the last five is as follows: 2015 (508,905 head), 2016 (504,819 head), 2017 (497,669 head), 2018 (506,661 head) and 2019 (524,109 head). The average increase in beef cattle breeding is still low, reaching only 1%. Efforts to improve must be balanced with better animal feed production. The general problem of beef production on smallholder beef cattle farms in Indonesia is the maintenance of cattle that still rely on forage feed which has low quality if given singly. It's can cause low feed digestibility and can lead to nutrient deficiency[1]. The provision of a single feed in the form of forage has not been able to meet the nutritional needs of both the rumen microbes and livestock itself so that other feed ingredients are still needed to supplement nutrition[2]. Another problem is that farmers do not know the nutritional needs that must be met and do not understand the technology of beef cattle feed processing.

The availability of forage in raising beef cattle in Indonesia depends on the season. The quantity and quality availability of forage has fluctuated and continued throughout the year and has an impact on cattle development. They need for alternative feeds that have full nutritional value to develop more efficient production. One alternative is the provision of highly nutritious food with a low economic cost is the use of agricultural waste[3]. Among them are rice crop waste (rice straw and rice bran), corn crop waste (straw and corn cobs), cassava plant waste (cassava peel and pulp), bean crop waste (peanut shells), soybean crop waste (soybean crust) and the waste sugar industry (molasses).

Agricultural waste production needs to be supported by proper management to reduce adverse environmental impacts. It can be used for other needs such as organic fertilizer, animal feed, soil mulch and others[4]. Utilization of agricultural waste into beef cattle expected to reduce the volume of waste and environmental pollution, reduce feed costs, increase the economic value added of farmers and encourage the development of integrated beef cattle agribusiness in an integrated production system with agriculture and the agricultural industry. This pattern of integration is known as the “zero waste production system”[5]. Processing of feed ingredients from agricultural waste into complete feed will have an impact on increasing nutrient density in the feed. The increase in nutrient density is mainly caused by the process of counting or making flour as a source of crude fibre feed[6].

The evaluation of feed ingredients and feed based on agricultural waste needed to determine the nutritional value and availability for livestock. It is that describe feed supplemented with information: nutritional value of feed includes dry matter, crude protein, crude fibre and crude fat, production performance including feed consumption, increase daily body weight, feed conversion, feed efficiency, Feed Cost per Gain (FGC) and Income Over Feed Cost (IOFC) and nutrient digestibility *in vivo* include the digestion of dry matter and organic matter[7,8]. Digestibility measurement by *in vivo* is the process that occurs in the animal’s body. While *in vivo* measurements occur outside the animal’s body by mimicking the digestive processes that occur in the animal’s digestive tract[9].

Cows fed concentrated feeds from agricultural waste can increase the daily bodyweight of cattle, meet the livestock’s living needs and will have a positive influence on growth in the amount of 0.156 kg/head/day[10]. Cow’s weight gain is higher if the cow is fed feed consisting of concentrates and forages The daily weight gain of beef cattle by forage and concentrate feed is 1.09 kg/head/day[10]. Economic analysis of cattle business is calculated through the value of Income Over Feed Cost (IOFC). IOFC derived because ≥ 70% of production costs come from the feed, so it can be known whether the feed used is economical or not[11].

The novelty of this study is the utilization of agricultural waste into complete feed using seven types of agricultural waste materials with a proportion of <75%. The purpose of this study was to determine the effect of feeding based on agricultural waste on production performance and digestibility of cattle nutrients *in vivo*.

## MATERIALS AND METHODS

Research on agricultural waste for animal feed is carried out for 3 months starting in June-September 2019. Testing is carried out in two stages, namely the testing phase in the field and testing in the laboratory-the research testing phase in the area.

**Materials:** The research used material in the form of four types of feed divided into four treatments. The treatments are P1, P2, P3 and P4. Objects of the study were 28 male cows of Simental and Limousine crossbreed with an initial body weight of cattle ranging 380.11±13.69 kg and cattle faeces samples of 112 samples from four treatments and seven replications. Feed formula made according to the nutritional needs of beef cattle in Table 1 and 2.

The feeding gives twice a day, morning and evening. The feed weighing is done once a month. Drinking water given to cattle is ad libitum and carried out every day. The consumption of agricultural waste feed and forage grass is calculated every day by weighing the amount of feed given and weighing the remaining feed.

**Methods:** The research has to stepwise as follows: Preparing. Preparing the condition of the cattle pen, beef cattle and feed treatment for adaptation object the research. In this step, the beef cattle are given anthelmintic Wormzol-B.

Introduce. Clustering the beef cattle by body weight, each cluster-randomized to get different treatments and cattle pen. The first treatment with weighing of each to get data of early bodyweight of beef cattle. And then, cows are grouped according to body weight. Each group

Table 1: Nutritional needs for female beef cattle weight 350-400 kg requirement amount (%)

| Requirement | Amount (%) |
|---|---|
| Coarse Protein (CP) | ≤11,15 |
| Coarse Fiber (CFi) | ≤15,14 |
| Coarse Fat (CF) | ≥8 |

NRC in 2001

Table 2: Feed formulation for beef cattle of research

| Ingredients | Formula P1 (%) | Formula P2 (%) | Formula P3 (%) | Formula P4 (%) |
|---|---|---|---|---|
| Corn cob | 8 | 34 | 22 | 26 |
| Corn kernels | 17 | 16 | 17 | 16 |
| Rice straw | 19 | 16 | 18 | 19 |
| Cassava skin | 16 | 3 | 7 | 4 |
| Cassava pulp | 2 | 2 | 2 | 2 |
| Soybean meal | 4 | 5 | 3 | 3 |
| Molasses | 3 | 3 | 3 | 3 |
| Urea | 1 | 1 | 1 | 1 |
| Peanut straw | 5 | 0 | 0 | 0 |
| Soybean straw | 5 | 0 | 7 | 6 |
| Forage | 20 | 20 | 20 | 20 |
| Nutritional content | | | | |
| DM (%) | 78.81 | 75.85 | 78.33 | 79.11 |
| CP (%) | 11.74 | 11.16 | 12.45 | 12.31 |
| CF (%) | 2.74 | 2.70 | 3.70 | 3.93 |
| CFi (%) | 15.14 | 17.89 | 17.98 | 17.14 |

of cattle was randomized to get the treatment applied as well as placement in a cage. The feed treatment phase begins with weighing each cow to get initial body weight data. Then every week the cattle are considered using a 2,000 kg capacity PHUN$^{3}$6LPD livestock with an accuracy of 1 kg. Data from the weighing of cows every week is used as guidelines for feeding the following week. During the treatment period, everyday cattle given fed (concentrate and forage) as much as 3% of body weight calculated in the BK (dry weight). According to the ability to eat the cows during the preliminary stage.
Implementation. The concentrate feed was given starts at 7:00 AM as much as 80% and two hours later much as 20% of the total feed given. Everyday drinking water is always provided by ad libitum. During the study, feeds and leftovers recorded daily. Digestion calculation of BK (dry weight) and BO (organic matter) were done using the method of total collection for once a week, so that, 112 stool samples obtained.

**Research indicator**

**Feed consumption:**

- Feed consumption = amount of leed given (kilogram)-amount of left over leed (kilogram)

**Daily Body Weight Increase (DBWI):**

- DBWI = Initail body weight (kilogram)-final weight (kilogram)/weight gain (kilogram)

**Feed efficiency:**

- Feed efficiency = Weight gain (kilogram)/feed consumption (kilogram)×100%

**Feed Cost per Gain (FCG):**

- FCG = Feed cost (IDR)/DBWI (kilogram)

**Income Over Feed Cost (IOFC):**

- IOFC = (DBW]×selling price)-feed cost (IDR)

**Dry Matter Digestibility (DMDi):**

- DMDi = (Total amount of dry matter-amount of dry matter faeces)/total amount of dry matter×100

**Organic Matter Digestibility (OMDi):**

- OMDi = (Total consumption of organic matter-amount of organic matter faeces)/Total consumption of organic matter×100%

**Analysis method:** The experimental data will be analyzed by analysis of variance according to the Completely Randomized Design (CRD) with a mathematical model[12]:

$$\sqrt{Y_{ijk} = \mu + \tau_i + €_{ijk}}\text{, where } Y_{ijk} = \text{observation result}$$

$$\sqrt{\mu = \text{general average}}\sqrt{E_i \text{ influence of treatment of } i(1,2,3,4)}$$

$$€_{ijk} = \text{trail error}$$

## RESULTS AND DISCUSSION

Particular agricultural waste and food crop waste has considerable potential as a source of feed for beef cattle. Production of crop waste as one of the local feed sources in an area needs to assessed so that its potential carrying capacity as feed source can be identified. The results of this assessment will contribute to the utilization of food crops for animal feed through appropriate programs based on regional resources. The application of feed processing technology is one of the determining factors in increasing the utilization of food plants as feed.

The use of agriculture in the form of straw, corn straw and rice bran in the manufacture of a consumption mix of 5.85-5.94 kg/head/day with the dry matter digestibility coefficient 27.84-27.92% and the ratio of digestion organic matter 30.23-33.69%[13]. The average value of DMDi and OMDi of feed consumed by livestock shows low cost.The indicates that there needs to be a feed formulation that is tailored to the needs of beef cattle based on body weight and physiological status.

Table 3: Utilization data of agricultural waste for performa production of beel cattle

| | Treatment | | | |
|---|---|---|---|---|
| Variables | P1 | P2 | P3 | P4 |
| Feed consumption (kg $d^{-1}$) | 9.10±0.74[a] | 9.16±0.86[a] | 10.20±0.43[b] | 8.55±0.79[a] |
| Daily body weight increase (kg $d^{-1}$) | 1.54±0.44 | 1.55±0.31 | 1.57±0.24 | 1.23±0.23 |
| Feed conversion ratio (kg of DM/kg of gain) | 6.42±2.33 | 6.17±1.57 | 6.65±1.14 | 7.11±1.03 |
| Feed efficiency (%) | 16.84±4.23 | 17.14±4.40 | 15.40±2.52 | 14.35±2.32 |
| Feed cost per gain | 19,780±1,623 | 21,693±2,061 | 25,027±1,077 | 20,762±1,941 |
| IOFC (IDR/head/day) | 57,005.21±21,418 | 55,663.87±16,633 | 53,329.85±12,058 | 40,595.09±10,654 |

Different superscripts on the same line show significant differences (p<0.05); P1: feed formula 1; P2: feed formula 2; P3: feed formula 3; P4: feed formula 4

The application of fermented feed technology from mixing feed ingredients and agricultural waste provides more benefits for increasing daily body weight and duration of cattle combining in a short time and providing financial advantages. Comparison of income from the daily value of beef cattle by grazing is only 0.15 kg/head/day whereas by complete fermentation the feed can reach 0.35 kg/head/day. Positively correlated with a financial gain during four months fattening with the fermentation of feed per cow can produce a profit of 3,090,000 IDR-while grazing 1,440,000 IDR-with the market price for beef at the time of the study being 80,000 IDR per kg[14].

The main feed for ruminants is green plants but the need is very limited in the dry season. Hence, the solution is the utilization of agricultural waste into complete forage feed. One of the farm waste that has the potential is corn, contains a lot of cellulose and hemicellulose as an energy source for ruminants. The provision of total mixed rations in the form of flour, pellets and wafers *in vivo* showed that it did not harm the performance of local goats[15].

Corn cobs as a source of fibre in total mixed rations containing 60% concentrate significantly increases nutrient intake and milk production in lactating dairy cows in the tropics to increase production efficiency[16]. Fresh young corn husk contains 94.3% organic matter, 11.7% crude protein, 62% NDF, 27% ADF, 24% cellulose and 35% hemicellulose[17]. *In vitro*, animal feed manufacturing techniques can be developed in areas that have the potential to produce agriculture and agricultural industries to increase the carrying capacity of livestock[18].

**Feedlot performa:** Data on the influence of utilization of agricultural waste on beef cattle performance including feed consumption, daily body weight gain, feed conversion and feed efficiency can in Table 3.

**Feed consumption:** Feed consumption is the amount of feed consumed by livestock in a certain period and calculated based on the difference from the amount of feed given less the remaining feed. The consumption of agricultural waste feed and forage grass is calculated every day by weighing the amount of feed given and weighing the remaining feed if available the next day. The results of the variance analysis showed that the utilization of agricultural waste had a significant effect (p<0.05) on the consumption of beef cattle feed. The highest data to the lowest were P-3 treatment (10.20 ± 0.43 kg/head/day), P-2 (9.16±0.86 kg/head/day), P-1 (9, 10±3.62 kg/head/day) and P-4 (8.55±3.50 kg/head/day). Increased consumption based on the dry matter is due to the increasing content of crude protein in feed (Fig. 1).

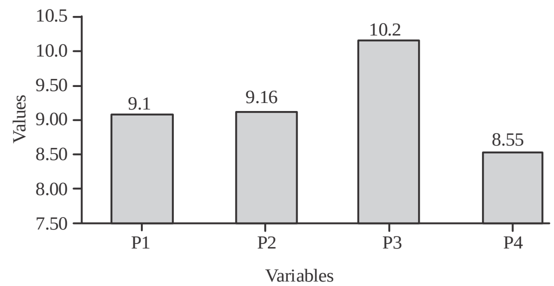


Fig. 1: Feed consumption of beef cattle; (kg $d^{-1}$)

The total nutrient content, especially in protein was different. In order, that differences in consumption based on the dry matter caused by differences in nutrient content, namely protein. Sufficient protein causes the activity and growth of micro-organisms to increase, so that, the process of digestion and consumption also increases[19]. Furthermore, the increase in protein content in feed would increase the breeding rate and rumen microbial population, so that, the ability to digest food becomes greater[20].

In the level of feed, factor consumption, there are includes the first feed factors. Including digestibility and palatability. The second, livestock factors which include the nation, sex, age and health conditions of livestock[21]. NRC states that beef cattle feed must meet the requirements including available throughout the year, high nutritional value, the price is relatively low. It does not contain poisons or anti-nutritional substances.

**Daily Body Weight Increase (DBWI):** Bodyweight gain is used to measure the growth of livestock weight every day until it reaches maximum growth and after that it has decreased. In general, the main criteria for beef cattle productivity is an increase in daily body weight (daily gain). Bodyweight gain influenced by factors of breed cows and feed provided.

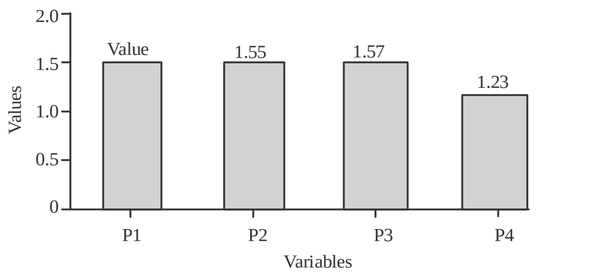


Fig. 2: Daily body weight increase (DBWI) of beef cattle (kg $d^{-1}$)

The results of the analysis of variance showed that the utilization of agricultural waste had no significant effect (p>0.05) on the daily weight gain of beef cattle. The highest to lowest numbers are consecutive treatment P-3 (1.57±0.24 kg/head/day), P-2 (1.55±0.31 kg/head/day), P-1 (1.54±0.44 kg/head/day) and P-4 (1.23±0.23 kg/head/day). The P-3 treatment had the highest PBBH because the highest P-3 crude protein content was 12.45% crude protein compared to P-1, P-2 and P-4 feed, respectively 12.27% crude protein, 11, 16 and 11.31%. Weight gain is closely related to protein intake into the body of cattle. High protein content also produces high weight (Fig. 2).

Protein intake is influenced by protein consumption and protein digestibility. The higher the use of protein and protein digestibility, the higher protein intake in the body of cattle. However, increased consumption of protein will cause a low ratio of efficient use of protein[22]. The increasing bodyweight of crossbreed beef cattle (Simental, Limousine, Charolais) in breeders after using research results can produce a daily body weight of 2.33 kg with an average of 1.54 kg[23].

The intensive fattening system is carried out by feeding concentrate from agricultural and agricultural industrial waste and commercial concentrate. Fattening cereal-based cows such as corn or sorghum did in cattle-producing countries. Several studies have shown that fattening cows based on cereal crops such as corn or sorghum which have relatively high energy content can increase cattle body weight gain from 0.90-1.54 kg per day[24, 25].

Feed conversion is the amount of feed consumed to produce one unit of livestock production[26]. Low feed conversion will provide a high output. It means that the better the quality of feed, the lower the conversion of feed produced[27]. The results of the analysis of variance showed that the utilization of agricultural waste had no significant effect (p>0.05) on the conversion of beef cattle feed. The highest to the lowest data were treatment P-4 (7.11±1.03), P-3 (6.65±1.14), P-1 (6.42±2.33) and P-2 (6.17±1.57). Small feed conversion values indicate that feed is more efficiently used by livestock to produce body

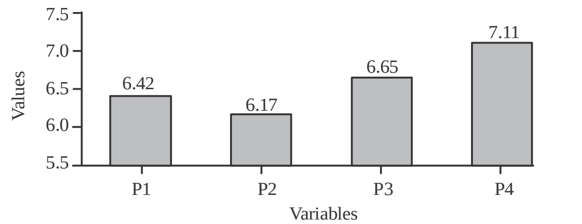


Fig. 3: Feed conservation ratio of beef cattle (kg of DM/kg of grain)

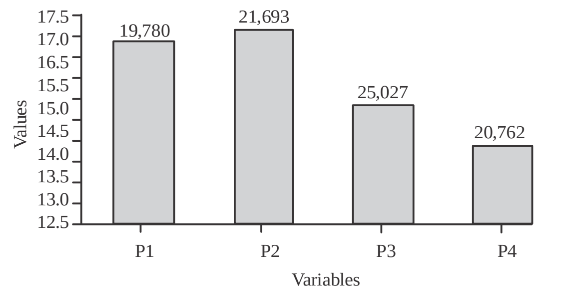


Fig. 4: Feed efficiency of beef cattle diagram (%)

weight. The best conversion is in the P-2 treatment which is 6.17. It means that to produce one kilogram of body weight, cows must consume 6.17 kg of dry matter (Fig. 3).

The feed conversion is a method to measure feed quality, how many kilograms of feed is needed to form one kilogram of beef[28]. But the conversion value of the research results is lower than the conclusion which states that feed conversion for good cattle is 8.56-13.29[29]. The feeds conventions influenced by the availability of nutrients in feed and animal health. One way to find out the economic value of feed consumed by livestock is the value of feed conversion[30].

**Feed efficiency:** Feed efficiency is the opposite of feed conversion; the higher the value of feed efficiency, the amount of feed needed to produce one kilogram of meat is less. Fat and energy in feed can improve feed efficiency because the higher the levels of fat and energy in feed, the higher the value of feed efficiency.

The results of the analysis of variance showed that the utilization of agricultural waste had no significant effect (p>0.05) on the daily weight gain of beef cattle. The highest to lowest numbers are P-2 (17.14±4.40%), P-1 (16.84±4.23%), P-3 (15.40±2.52%) and P-4 (14.35±2.32%). Higher feed efficiency values indicate that feed consumption is lower to produce ideal body weight gain (Fig. 4).

The higher value of the use of feed efficiency indicates that the ration consumed less and less to produce weight gain[31]. Efficient use of feed for beef

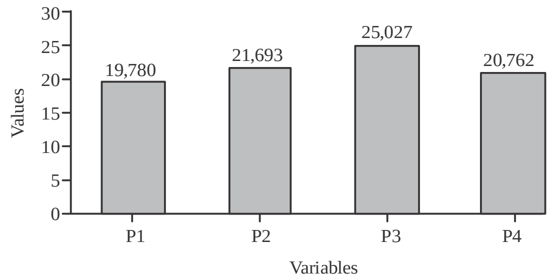


Fig. 5: Feed cost per gain (IDR kg$^{-1}$) of beef cattle

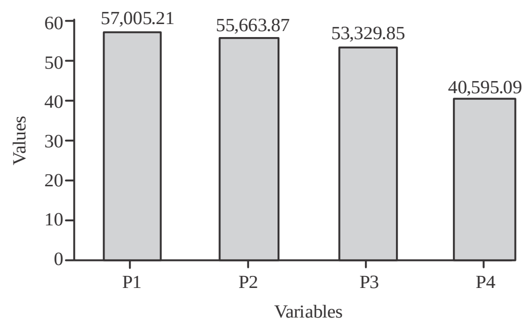


Fig. 6: Income over feed cost of beef cattle (IDR/head/day)

cattle ranges from 7.52-11.29% while the average efficiency value in this study is higher at 17.14%. It is due to the feed given at the time of research in the form of agricultural waste and forages with the excellent quality, so that, it can be optimized by livestock. The better the quality of feed, the better the efficiency of energy formation and production[32]. Efficient use of feed influenced by several factors including the age of livestock, the ability of animals to digest feed ingredients, adequacy of nutrients, quality of feed as well as the type of meal used[33].

**Feed cost per gain:** Feed cost per gain is the number of feed costs required for livestock to produce one kilogram of weight[34]. Feed cost per gain calculated from feed costs divided by daily body weight gain[35]. Based on the results of a variety of analysis shows that the utilization of agricultural waste has no significant effect (p>0.05) on the feed cost per beef cattle gain. The highest to lowest data respectively are treatment P-3 (25,027±1076,821 IDR/kg), P-2 (21,693.27±2,061 IDR/kg), P-4 (20,762±1,941 IDR/kg) and P-1 (19,780±1,380 IDR/kg). Feed cost per gain is good if the value is getting lower. The results showed that the lowest value of feed cost per gain (Fc/g) was P-1 (19,780 IDR/kg). This figure can be interpreted to increase body weight by one kilogram required feed costs of 19,780 IDR. The Fc/g value is quite low due to the high efficiency of feed which is 16.84%,

Table 4: Analysis result of DMDi and OMDifaeces of beef cattle

| | Treatments | | | |
|---|---|---|---|---|
| Variabels | P1 | P2 | P3 | P4 |
| DMDi (%) | 71.35±2.01$^{a}$ | 68.63±3.62$^{a}$ | 75.48±1.46$^{b}$ | 66.75±0.95$^{a}$ |
| OMDi(%) | 68.42±0.87 | 67.68±1.44 | 69.14±1.21 | 63.04±0.94 |

so, the feed consumed by cows can provide DBWI of 1.54 kg/head/day. This figure indicates the daily weight gain achieved is proportional to the cost of feed that has been spent (Fig. 5).

Feed cost per gain considered good if the figures obtained are as low as possible which means economically in terms of efficient use of feed[36]. According, to get a low feed of cost, the daily weight gain must be as much as possible. The feed cost per increase figure can be reduced by optimizing DBWI and lowering the cost of feed by using feed that is more efficient but suitable for livestock needs[31].

**Income over feed cost:** The calculation of Income Over Feed Cost (IOFC) carried out to determine the economic value of feed on the income of beef cattle farmers. IOFC calculated because ≥70% of production costs come from the feed, so, it can be known whether the rations used are economic or not. The IOFC calculated because the cost of feed ranges from 60-80% of the total cost of the product. Producer income is the difference between the sale of output and production costs[37] (Fig. 6).

Based on the analysis of variance shows that the utilization of agricultural waste has no significant effect (p>0.05) on beef cattle IOFC. The highest to lowest data are P-1 (57,005.21±21,418 IDR/head/day), P-2 (55,663.87±16,633 IDR/head/day), P-3 (53,329.85± 12,058 IDR/head/day) and P-4 (40,595.09±10,654 IDR/ head/day). Based on the results of the study, the highest IOFC was found in P-1 treatment, namely 57,005 IDR/head/day. This is influenced by cheap cost-per-gain feeds with high DBWI.

The factors that influence the calculation of IOFC are body weight gain during fattening, feed consumption and feed price. High weight gain does not necessarily guarantee increased profits, but low feed costs followed by growth and excellent feed efficiency will yield maximum benefits[38].

**Dry Matter Digestibility (DMDi) and Organic Matter Digestibility (OMDi):** Digestion is the difference between food consumed and excreted in the faeces and considered absorbed in the digestive tract. So, digestibility is a reflection of the number of nutrient feed ingredients that can be utilized by livestock. High or low digestibility of feed ingredients means that how much feed ingredients contain food substances in a form that can be digested in the digestive tract (Table 4).

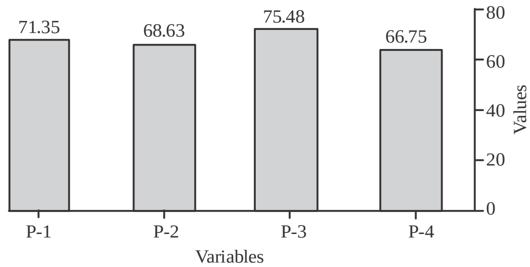


Fig. 7: Dry matter digestibility (%)

**Dry Matter Digestibility (DMDi):** Based on the results of various analyzes showed that the utilization of agricultural waste significantly ($p<0.05$) on the digestibility of dry beef cattle. The highest to the lowest data were treatment P-3 (75.48±1.46%), P-1 (71.35± 2.01%), P-2 (68.63±3.62% ) and P-4 (66.75±0.95%). P-3 treatment has the highest DMDi which is influenced by feed consumption compared to other treatment feed consumption (Fig. 7).

The *in-vitro* digestibility measurement is a measurement that the process occurs in the animal's body. But *in-vivo* measurements occur outside the animal's body by mimicking the digestive processes that occur in the animal's digestive tract[9]. Size of the digestibility of a feed ingredient is an attempt to determine the number of nutrients from a feed material that degraded and absorbed in the digestive tract[24]. Digestibility is also the presentation of nutrients absorbed in the gastrointestinal tract whose results will know by looking at the difference between the number of nutrients eaten and the number of nutrients released in the stool[25]. Nutrients that are not present in these faeces are assumed to be digested and absorbed. The large amount of food that can be understood by the animal's body can be determined by measuring the digestibility of dry matter and organic matter[39].

The impact of increased digestibility can provide more essential nutrients to microbes. Microbial activity increases and positively influences the digestibility of dry matter[19]. Feed digestibility closely related to feeding consumption. That is the higher the digestibility value of a feed ingredient, the more consumption or vice versa, the feed with a lower digestive cost tends to lower the consumption value[40].

High-value digestibility reflects the contribution of specific nutrients to livestock. Meanwhile, feed which has a low digestibility indicates that the meal is less able to supply nutrients for basic life and livestock production purposes[41]. The digestibility value of the dry matter in complete meal ranged from 62.12-65.51%. Digestion value of treatment P-3 showed that the digestibility value of dry weight was 65.63%. This value indicates the feed has excellent dry matter digestibility[42].

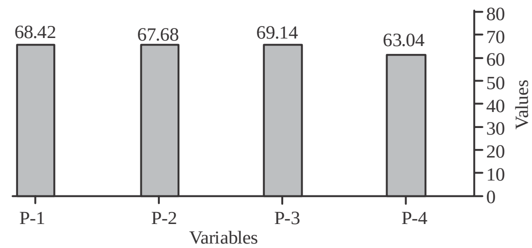


Fig. 8: Organic matter digetibility

**Organic Matter Digestibility (OMDi):** The Organic Matter Digestibility (OMDi) described the condition of digestibility of protein, fat and carbohydrates in the body of beef cattle. The results of the analysis of variance showed that the utilization of agricultural waste had a significant effect ($p<0.05$) on OMDi in beef cattle. The highest to lowest data are P-3 treatment (69.14±1.21%), P-1 (68.42±0.87%), P-2 (67.68±1.44% ) and P-4 (63.04 ± 0.94%). P-3 treatment had the highest digestibility of organic matter which was affected by the protein content of the feed compared to other treatment feeds (Fig. 8).

The protein is a part of organic matter if the protein content of feed increases, the range of organic matter in the feed also increases[43]. Increasing protein levels in the feed will increase the breeding rate and rumen microbial population, so that, the ability to digest food becomes greater[20]. Several things that affect the digestibility of feed ingredients include the chemical composition of feed ingredients, feed composition, physical form of feed, feed level and internal factors of livestock[39].

Factors affecting the digestibility of organic matter are the content of crude fibre and minerals from feed ingredients. Digestion of organic matter is closely related to the digestibility of dry matter because some of the dry weight consists of organic matter[24]. High-value digestibility reflects the contribution of specific nutrients to livestock. Meanwhile, feed which has a low digestibility indicates that the meal is less able to supply nutrients for basic life and livestock production purposes. According to research by Riswandi *et al.*[42], OMDi in complete feed ranged from 76.59-79.96%. The digestibility of organic matter research feed has a value below the standard limit of 69.14%[42].

## CONCLUSION

The research has a conclusion as follows: P3 treatment is the best feed to increasing feed consumption and has an excellent performa product for improve the digestibility of beef cattle nutrition. Utilization of agricultural waste as beef cattle feed with treatments P1, P2, P3 and P4 does not affect in daily body weight increase, feed conversion, feed efficiency, feed cost per gain and income over feed cost.

**Simple summary:** Agricultural waste is very abundant in tropical countries such as Indonesia. Its existence can be beneficial or detrimental. If not appropriately managed, agricultural waste becomes a carbon contributor that has an impact on climate change. Conversely, if it used, it can be converted into animal feed to replace forage for livestock. This study aims to see the impact of animal feed made from agricultural waste with four different treatments on the performance of beef cattle production. The results showed that the treatment of feed formula (P3) had the best effect on increasing feed consumption and had an excellent product performance to improve the digestibility of beef cattle nutrition. With this result, it hoped that it could help farmers to get significant production yields and profits.

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