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EVALUATION OF CORN FORAGE NUTRITION VALUE IN A COMPLETE FEED ON RABBIT PRODUCTION PERFORMANCE

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Abstract

This study aims to obtain the best ration using corn cane in complete feed for rabbit production performance in terms of feed consumption, weight gain and feed conversion. it used 30 male rabbits of the New Zealand White strain in the range of 435-1.037 g were used. The ration consists of a mixture of corn sugarcane and other feed ingredients, such as corn, coconut meal, pollard, bran, sugar drops, and minerals purchased from animal feed stores. The formulated feed ingredients have a complete feed without using grass. The treatments carried out were corn cane in complete feed in the form of pellets as follows: R0 = feed without corn cane, R1 = feed with 10% corn cane, R2 = feed with 20% corn cane, R3 = feed with 30% corn cane, and R4 = feed with 40% corn cane. Results showed that the highest feed consumption occurred in treatment R3, 72.81 g/head/day. The highest weight increment was observed in treatment R3, 23.24 g/head/day. However, treatment R3 gave the lowest food conversion. It indicates that this treatment is more efficient feed to use. This study also concluded that the use of 30% corn cane gave the best performance.

Key words*: conversion, consumption, corn cane, rabbit, weight gain.*

INTRODUCTION

The purpose of cultivating maize by breeders in North Sulawesi is dual function, namely obtaining corn kernels as food for pakok for rural communities or as a main source of food and forage corn as a source of animal feed. If the objective is prioritized for food sources and forage only as a by-product, it requires a high variable cost because the productivity of the seeds is highly dependent on fertilization. In this era, the people of North Sulawesi can hardly be found consuming corn kernels as a staple food source. Corn kernels are a very good source of carbohydrates for non-ruminant and ruminant livestock, therefore the selling value of these corn kernels will increase as a source of feed if converted into food sources (Tuturoong et al., 2020). Corn cliffs are all corn plants consisting of stalks, leaves, cobs and fruit which harvest at 45-65 days of age (Srichana et al., 2014). Because they are harvested at an early stage of growth, plant residues including stalks, leaves, husks and maize silk (corn silk) are a source of excellent quality, fresh and palatable feed for livestock. The breeder could take advantage by using plants as natural resource to improve its production (Rumokoy et al., 2014; Sumolang et al., 2020; Toar et al., 2020)

The minimum consumption of animal protein for Indonesian people by the Food and Agriculture Organization (FAO) is recommended as much as 6 gr/capita/ day but until now the protein consumption is still below the standard, namely 4.19 gr/capita/day. To achieve this target, the government is trying to improve and develop the livestock sub-sector, where one of the animal protein-producing commodities that is quite potential to be developed is rabbit livestock. The advantages of rabbits as a meat producer are good quality meat, namely 21% high protein content, 160 kcal calories, 8% fat, 70% water and 71 mg cholesterol (Winarno, 1992). Rabbits are suitable livestock to be kept in developing countries and are starting to use rabbits as a source of meat. In addition, rabbits also have potential, among others; small body size so that it does not take up much space; does not require a large investment in livestock and pen; short adult life which is about 4-5 months; high breeding ability and short fattening period, which is less than 2 months after weaning (Belabbas et al., 2019).

An innovative technological approach that enables effectiveness of growth and production,

namely through the application of complete forage-based feed using reinforcement feed (Rumokoy et al., 2021), through the complete feed formulation technique will be effective associative or complementary effects between the components of feed nutrients in forage grass with reinforcing feed, which in turn achieve the fulfillment of nutrition and rabbit cattle production.

Based on the description above, a study was conducted on the evaluation of the biological value of complete corn-sugarcane based feed on the performance of rabbit livestock production.

MATERIALS AND METHODS

Feeding trial used 30 male rabbits of New Zealand White strains with initial lived weight range of 435-1037 g obtained from public farm, corn cane, and other feed materials, such as corn, coconut cake, pollard, bran, sugar drops, and other materials bought from animal's feed material shops. These feed materials were formulated to make complete feed without the use of green feed.

Animal's cages of 50 x 50 x 60 cm^3 were prepared and facilitated with feeding and drinking spots, balance, room thermometer, and other supporting equipment.

The study was experimental with Group Randomized Design based upon the initial body weight of the rabbit. Variance coefficient (VC) was 23.77% (VC>10%) meaning that the initial body weight of the rabbit was not homogenous, so that they were separated into 3 groups, a) rabbit group of low body weight, 435 g, 456 g, 471 g, 480 g, 497 g, 535 g, 556 g, 574 g, 584 g, and 590 g (VC = 9.07%), b) rabbit group of medium body weight, 612 g, 620 g, 694 g, 708 g, 712 g, 721 g, 736 g, 747 g, 781 g, and 780 g (VC= 8.13%), and c) rabbit group of high initial body weight, 787 g, 814 g, 818 g, 830 g, 860 g, 878 g, 888 g, 960 g, 1016 g, and 1037 g (VC= 9.82%).

The treatment feed was separated into 5 levels of concentrations with 3 replications, so that there were 15 experimental units, and each experimental unit had 2 individuals, so that there were 30 individuals of rabbits used. The concentration levels of rumen content and sludge mixture fermented with *Cellulomonas* sp in the complete feed made in pellet form were set as follows:

R_0 = Feed without corn cane;
R_1 = Feed with 10% corn cane;
R_2 = Feed with 20% corn cane;
R_3 = Feed with 30% corn cane;
R_4 = Feed with 40% corn cane.

Table 1. Feed material nutritive content (in dry matter)

Ingredients	Nutrient Content						
	Dry matter (%)	Crude protein (%)	Crude fiber (%)	Ether Extract (%)	Calcium (%)	Phosporus (%)	Metabolizable energy (kcal/kg)
Corn cane	89.04	12.45	25.12	1.30	0.27	0.19	2,352
Pollard	88.54	16.50	14.90	4.00	0.14	0.32	1,300
Yellow corn	88.76	8.60	2.70	3.90	0.02	0.10	3,400
Coconut cake	87.92	18.50	15.00	2.50	0.20	0.57	2,200
Bran	87.82	11.56	13.36	7.00	0.04	0.16	2,860
Concentrate	88.78	38.00	11.14	5.90	1.40	1.20	2,600
Molases	87.50	3.00	0	0.10	0.90	0.10	1,960

Table 2. Composition and nutrient content of treatment feed

Materials	Treatment				
	R_0	R_1	R_2	R_3	R_4
Corn cane (%)	0	10.00	20.00	30.00	40.00
Pollard (%)	26.00	27.00	26.00	26.00	20.00
Corn (%)	22.00	19.00	16.00	10.00	8.00
Coconut cake (%)	15.00	8.00	7.00	6.00	5.00
Bran (%)	18.00	17.00	12.00	10.00	9.00
Concentrate (%)	17.00	17.00	17.00	16.00	16.00
Molases (%)	2.00	2.00	2.00	2.00	2.00
Total (%)	100	100	100	100	100
Dry Matter (%)	88.39	88.18	87.97	87.72	87.48

Materials	Treatment				
	R_0	R_1	R_2	R_3	R_4
Crude Protein (%)	17.56	17.30	17.36	17.29	17.07
Crude Fibre (%)	11.02	12.51	14.08	16.00	17.38
Ether Extract (%)	4.54	4.35	3.95	3.63	3.35
Calcium (%)	0.33	0.35	0.37	0.38	0.39
Phosporus (%)	0.43	0.40	0.40	0.39	0.38
Metabolizable Energy (kcal/kg)	2,412	2,447	2,473	2,470	2,579

Notes: Processed feed nutrient content.

The rabbits were divided into 3 groups of body weight, light body weight group (K1), medium weight group (K2), and heavy body weight group (K3), each of which was given treatment R_0, R_1, R_2, R_3, and R_4. The placement of each animal group and treatment in each group was randomly done using random numbers.
The *in vivo* research activities were divided into 3 phases as follows:

Adaptation phase.

- Male rabbits of New Zealand White strain of 8-11 weeks old were selected, weighed, and separated into 3 groups as small, medium, and large initial weights.
- The selected rabbits were put into a 50 x 50 x 60 cm metabolic cage using battery system and the placement of the experimental units was randomly set using random number with one individual per experimental unit. After the rabbits had been caged, they were adapted to experimental feed for 10 days.
- The need of each feed material was calculated following the treatment feed formulation.

Preliminary feeding adaptation

All experimental rabbits were fed 3 times a day at 07.00 am, 12.00, 17.00 pm of local time. This preliminary study was intended to eliminate the previous feed effect and to determine the amount of feed given. This activity was done for 5-10 days.

Data collection

The amount of the treatment feed was prepared a day before feeding, while weighing the remaining feed was carried out in the next morning (at 06.30 - 07.30 am) and each unfed feed was placed in prepared buckets. The data were used to know the amount of feed consumed and the feed was stocked for 3-5 days feed treatment. Data collection was conducted for 40 days.

Measurements

Feed consumption (g/head)
Daily feed consumption = amount of feed given - the amount of uneaten feed.
Body weight increment (g/head).
Body weight increment = final lived body weight - initial body weight during the study.

Feed conversion
Feed conversion was obtained from ratio of feed amount consumed and body weight increment in weight and time unit.

$$\text{Feed Conversion} = \frac{\text{Amount of feed consumed}}{\text{Body weight increment}}$$

Statistical analyses

The study used Group Randomized Design in linear model as follows:

$$Y_{ij} = \mu + T_i + \beta_j + \epsilon_{ij}$$

where:
Y_{ij} = observed value of treatment *I,* group *j;*
μ = general median;
T_i = effect of treatment *I;*
B_j = effect of group *j;*
ϵ_{ij} = experimental error of treatment *i*, group *j;*
$_i$ = treatment;
$_j$ = group.

The observed values obtained by the model above were analyzed with ANOVA and then continued with Duncan's Multiple Range test if there was significant effect in order to know the difference between treatments.

RESULTS AND DISCUSSIONS

Table 3 demonstrates the outcomes of the use of corn cane in the complete feed on the rabbit livestock production performance.

Table 3. Mean feed consumption, weight increment, and food conversion

Variables	Treatments				
	R_0	R_1	R_2	R_3	R_4
Feed consumption (g/head/day)	66.64^{ab}	66.83^{ab}	71.34^{ab}	72.81^{b}	64.55^{a}
Weight increment (g/head/day)	16.65^{ab}	16.24^{ab}	17.24^{ab}	23.24^{b}	15.20^{a}
Conversion	4.00	4.11	4.13	3.13	4.24

Notes: different alphabets indicate highly significant difference (P<0.01)

Effect of corn cane in the complete feed on feed consumption.

The growth of rabbit, like other animals depends on feed consumption and utilization. Feed consumption is very important factor in rabbit livestock productivity determination (Fadare, 2015; Maidala et al., 2016; Moningkey et al., 2016). Results showed that the highest feed consumption occurred in treatment R_3, 72.81 g/head/day (Table 3). Nurhayati et al. (2006) found that one of the benefits of fermentation was to raise the feed quality and palatability. According to Khan et al. (2017), there are several internal or external factors affecting the consumption level of the livestock, environmental temperature, palatability, taste, physiological status, nutrient concentration, feed shape, and livestock body weight.

Effect of corn cane in the complete feed on daily weight increment.

Bhatt et al. (2017) stated that one of the factors influencing the body weight increment is feed consumption. High feed consumption and digestibility will yield higher weight increment. It could result from increasingly numerous nutrients absorbed by the livestock's body. This is supported by Pascual (2014) that the livestock body weight is directly proportional to the feed consumption level. It means that feed consumption will illustrate the nutrients taken by the livestock affecting the livestock's weight increment. According to Bhatt et al. (2017), there is close correlation between growth and food consumption. Increasingly higher feed consumption will increase protein consumption so that higher livestock growth could occur and will consequently raise the meat production. The nutrients taken by the rabbit are utilized to fulfil the major living needs and growth.

Effect of cern cane in the complete feed on food conversion.

Food conversion is the ratio of feed amount consumed by the livestock and body weight increment. Food conversion is inversely proportional to feed efficiency, in which the lower the food conversion is, the higher the feed efficiency, so that it will affect the production costs (Belabbas et al., 2019).

Based on Table 3, it is apparent that mean food conversion be 4.00 (R_0), 4.11 (R_1), 4.13 (R_2), 3.13 (R_3), and 4.24 (R_4).

Mean food conversion of the rabbit in the present study is higher than that of previous study (Habib et al., 2004), 2.62-3.46, with mean value of 3.00, that employs feed containing 16% PK, DE of 2,500 kcal/kg and 0.1% biovet. Rabbits are efficient converter of forage in to good quality animal protein compared to other livestock (Pasupathi et al., 2015).

Food conversion could also be influenced by several factors, such as gene, feed shape, temperature, environment, feed consumption, fresh weight, and sex. Moningkey et al. (2016) stated that food conversion is affected by consumption of dry matter, and daily weight increment.

CONCLUSIONS

The supply 30% mixture of corn cane in complete feed showed the best results related to the consumption, body weight gain and feed conversion of rabbit livestock ration.

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