Potential of sappan wood extract as a feed additive on the feed conversion on organic matter digestibility on the buck exposed to heat stress

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Abstract. The aim of this study was to determine the potential of sappan wood extract as a feed additive on feed conversion and organic matter digestibility on the buck exposed to heat stress. The study used with 4 treatments and 5 repetitions. The experimental animals were 100 bucks of Rex type at 5 months of age. The average weight of the buck was ±1.8 kg. Afterward, the bucks were divided into 4 groups and given different treatment for 4 weeks, namely K+ (basal feed + heat stress), K− (basal feed + ambient temperature), P1 (basal feed + sappan wood extract 100 mg/kg + heat stress) and P2 (basal feed + sappan wood extract 300 mg/kg + heat stress). Data were recorded in the fourth week after observation based on the feed conversion ratio and Organic matter digestibility. The average score of the feed conversion of K+, K−, P1, and P2 was 6.79; 6.41; 6.10; 6.14 respectively. The average score of organic matter digestibility of K+, K−, P1, and P2 was 74.247; 74.310; 73.916; 73.804 respectively. The results of this study indicated that there were significant differences (p < 0.05) in the treatment and control group.

1. Introduction
In Indonesia, rabbits are underdeveloped due to low information to the public about the products produced and the economic value of rabbits [1]. Rabbit is a commodity that is easy to breed, requires low capital, relatively low production costs, and easy maintenance [2].

Rabbits increased in 2016 compared to 2015 which was 8.93% of 1.2 million heads [3]. The advantage of rabbit meat is that it has a smoother structure, while the color and shape of the meat is more like chicken meat so that it can be used as an alternative opportunity for animal protein needs [4,5]. Rabbit carcasses weigh about 50-60% of live weight [6]. One of the ways to increase livestock productivity can be seen from weight gain. The availability of cheap feed production and the fulfillment of nutrient needs in livestock can result in feed efficiency [7,8]. The form of efficiency value can be seen from the feed ingredients given to livestock such as feed consumption and high levels of digestibility, the higher the amount of nutrients that can be absorbed by livestock, the higher the digestibility level of the feed ingredients, resulting in increased feed use efficiency [9].

Feed consumption in livestock is influenced by 2 factors, namely external factors and internal factors. Internal factors are factors that affect feed consumption originating from the condition of the livestock body itself, such as age, sex and production, while external factors are factors that affect feed consumption from...
the surrounding environment, such as temperature, humidity, wind speed, solar radiation, body temperature, palatability and form of feed [10,11]. High environmental temperatures ranging from 30°C-34°C can trigger heat stress [12]. The decrease in feed consumption and the increase in drinking water consumption are the effects of an increase in environmental temperature which causes weight loss. The definition of heat stress based on the Association of Farmer Opportunity Program (AFOP) is the loss of the body's ability to maintain homeostasis as measured by increased head and body temperature [13,14]. Efforts can be made to reduce stress on livestock by adding types of feed in the form of feed additives.

Giving natural feed additives can reduce stress, improve weight gain, feed conversion, carcass percentage, can optimize the work of the digestive tract in digesting and absorbing nutrients [15]. Herbal plants that can be used as feed additives include sappan wood. Secang wood contains chemicals such as gallic acid, resin, resorcin, brazilin, d-α-phellandrene, oscimene, and essential oils. Secang wood extract phytochemical compounds of Secang wood include alkaloids, flavonoids, and saponins. Chemical compounds that act as antioxidants in sappan wood are brazilin and flavonoids [16,17]. Antioxidants in livestock can improve the immune system which functions as an antidote to free radicals in the body [18].

Based on the description above, the addition of sappan wood extract which contains antioxidant compounds to determine the problem of feed conversion and organic matter digestibility in male rabbits exposed to heat stress is still unknown, therefore there is a need for research on the effect of adding sappan wood extract on feed conversion and material digestibility organic matter in male rabbits exposed to heat stress.

2. Materials and Methods

2.1 experimental design

The experimental animals in this study used 100 rex’s buck with the age of 5 months. Rabbits used are in healthy condition. The experimental animals used were divided into 4 treatments with each treatment having 5 replications. This study used a completely randomized design (CRD) which consisted of four treatments by repeating five times. Each treatment consists of K+ (complete feed + heat stress), K- (complete feed), P1 (complete feed + secang wood extract 100 mg / kg feed + heat stress) and P2 (complete feed + extract of secang wood 300 mg / kg of feed + heat stress) given for 4 weeks. Heat stress is made by giving heat exposure made from a 5 Watt bulb for 12 hours.

The materials used in this study used standardized basalt feed then given a feed additive of secang wood extract, drinking water, disinfectant, antiseptic, individual rabbit cage, feed bin, drinking bowl, 5 Watt bulb net, pellet maker, extraction maker and weighing equipment.

2.2 Preparation of Secang Wood Extract

Secang wood powder is weighed as much as 1 kg. Then soaked in 5 liters of 96% ethanol which was put in a glass jar for 3 days. The result of the immersion is carried out by a filtering process to produce a perfect filtrate. The filtrate formed was then filtered with filter paper to separate the Brazilin compound from the solvent, the filtrate was evaporated using a vacuum rotary evaporator until a thick extract was obtained. Secang wood extract was weighed and mixed with 1.5% CMC Na as an adhesive in a spray bottle. Complete feed is placed on the prepared baking sheet, then spray Complete feed on the baking sheet until homogeneous. Feed that has been sprayed and then baked for 3 to 4 hours at a temperature of 45°C.

2.3 Rearing system

The cage and equipment to be used are prepared and cleaned in advance. Then the cage is disinfected using a disinfectant. Places to feed and drink antiseptic soaked. Rabbit rearing was carried out for 28 days and the rabbit adaptation period was 10 days by gradually feeding forage and concentrates and adding feed additives until they could be fully replaced and drinking water ad libitum. Rabbit maintenance is carried out according to the desired treatment. Feeding every day as much as 180 g / head. Feed treatment was
given twice a day, namely in the morning at 06.00-07.00 am and afternoon at 4.00-5.00 pm. The heat stress treatment begins after the adaptation process is complete. Provision of heat exposure from the light bulb starts at 06.00 am and is turned off at 04.00 pm. The light bulb is adjusted using a thermoregulator to adjust to the desired temperature. Exposure to heat stress was carried out for 12 hours [19].

Manure sampling was carried out in the last week for one week, namely on days 21-28. Manure samples were taken as many as 20 rabbits were put into plastic separately and then their wet weight was weighed using a scale and labeling according to the treatment given. Manure samples were dried in an oven for 12-24 hours at a temperature of 60°C. Each dried manure was then taken 50% of the total dry weight and stored in the freezer for one week at a temperature of -15°C to prevent spoilage. manure that had been stored in the freezer was then analyzed of proximate [20]. The collection is carried out at the feeder and those that fall on the bottom of the cage. The remaining feed is then weighed using a scale and put in a plastic bag. The remaining feed weight data will be used to calculate feed consumption [21].

Digestibility calculations using conventional methods or total collection with a period of faecal collection and feed consumption carried out for 7 days. Determination of organic matter digestibility was carried out by proximate analysis. Digestibility of organic matter is obtained from the difference between Consumption of Organic Matter and Dry manure, then divided by Consumption of Organic Matter and the result is multiplied by 100%, therefore we need data on Consumption of Organic Materials obtained from the difference between the feed given multiplied by the Organic Matter of feed and the rest of the feed multiplied manure organic matter. Feed consumption is calculated based on the number of rations consumed per day by looking at the weekly recording [22]. The calculation of the feed conversion value is by comparing the amount of ration consumed with weight gain at a certain time [23].

2.4 Statistical analysis
The data obtained and collected during the study will be analyzed using SPSS Version 26.0 software. The data was tested by Analysis of Variance p< 0.05 SPSS v.26 and if there was a significant difference, it would be continued with Duncan's multiple distance test (5%).

3. Result and Discussion
3.1 Feed conversion ratio
The results of data analysis using analysis of variance showed that there was no significant difference (p>0.05) between P1 and P2, for K+, there was a significant difference with K-, and for P1 and P2 there is a significant difference (p<0.05) with K+ and K- and the lowest feed conversion results in this study is that there is a very significant difference between P1 and P2 with K+, so that the provision of a feed additive of sappan wood extract can affect the conversion male rabbit feed.

Feed conversion is a benchmark to determine the level of efficiency in the use of feed. The high feed conversion means the efficiency level of feed use is low, on the contrary if the feed conversion is low then the efficiency level of feed use is high [24]. The addition of a feed additive of sappan wood extract (Caesalpinia sappan L.) with a dose of 100 mg/kg feed and 300 mg/kg feed at P1 and P2 caused a very significant difference with K+, this was caused by the quality of the feed consumed, environmental factors, texture. feed, palatability, level of consumption and weight gain. According to [25] and [26] increased protein digestibility will cause an increase in protein retention that can be utilized by the body, so that it can affect growth which is characterized by an increase in body weight. Heat stress experienced by livestock can trigger a number of physiological, anatomical or behavioral changes in an effort to maintain heat balance. Data from several research results show that there are changes in behavior, water consumption and feed consumption and digestion in both ruminants and poultry caused by heat stress. Livestock exposed to high environmental temperatures will increase the effort to release body heat which results in increased respiration, body temperature and water consumption and reduces feed consumption [16].
Iwagami [27] stated that high ambient temperature can adversely affect cell structure and physiology. Cells produce small amounts of free radicals or ROS during normal metabolic processes. High ambient temperature conditions affect the FCR because of its effect on the thermoregulatory process. On the other hand, at low (cold) temperatures higher growth rates but also higher FCRs were observed compared to fattening when heat stress occurred [28].

Changes in the function and metabolism of cells and tissues including immune system cells are the impact of high environmental temperatures. Conditions like this in the administration of antioxidants proved beneficial to improve immune function [29]. Herbal antioxidants in medicinal plants can inhibit the negative effects of environmental stress and can improve immune function against various types of diseases and consequently increase the performance of chickens [30]. Secang wood contains active compounds in the form of brazlin, flavonoids and phenolics. The brazlin compounds in sappan wood besides functioning as antioxidants also function as natural red dyes, while the flavonoid and phenolic compounds are antioxidant compounds that play a role in neutralizing free radicals [31].

According to [32] flavonoids can provide antibacterial activity whose mechanism of action is to inhibit nucleic acid synthesis, inhibit cell membrane function and inhibit energy metabolism. Flavonoid compounds that function as antioxidants can increase the production of mucus in the villi to maintain intestinal epithelial homeostasis. This condition results in increased digestion and absorption of food substances in the digestive tract [33]. The results of feed conversion which showed significant differences could be interpreted that the use of a feed additive or feed additive with the provision of sappan wood extract could reduce the feed conversion of an animal.

### Table 1. Score mean and standard deviation of feed conversion ratio of buck for each treatment.

| Treatment                                           | FCR           |
|-----------------------------------------------------|---------------|
| K+ : Basal feed + heat stress                       | 6.7886 ± 0.11364 |
| K- : Basal feed                                     | 6.4135 ± 0.04862 |
| P1 : Complete feed + secang wood extract 100        | 6.1053 ± 0.08823 |
| mg/kg feed + heat stress                            |               |
| P2 : Complete feed + secang wood extract 300        | 6.1379 ± 0.03879 |
| mg/kg pakan + heat stress                           |               |

a,b,c Different superscripts in the same row show significant difference (p<0.05). K+ (complete feed + heat stress), K- (complete feed), P1 (complete feed + secang wood extract 100 mg/kg feed + heat stress) and P2 (complete feed + extract of secang wood 300 mg/kg of feed + heat stress)

### 3.2 Digestibility of Organic Materials

The results of data analysis using analysis of variance (ANOVA) showed that there was no significant difference (p > 0.05) between P1 and P2 between P1 and P2, while between P1 and P2 there was no significant difference between the digestibility of organic matter in male rabbits. (<0.05) with K-. The results of the digestibility of organic matter in this study showed that there was a very significant difference between P1 and P2 with K+, so that the feeding additive of sappan wood extract could affect the digestibility of organic matter in male rabbits.

Kearl [34] stated that there are 3 categories of feed quality based on the level of digestibility, namely the digestibility value in the range of 50-60% is the lowest, 60-70% is moderate and above 70% is said to be high. The addition of a feed additive extract of sappan wood (Caesalpinia sappan L.) with a dose of 100 mg/kg feed and 300 mg/kg feed at P1 and P2 caused a very significant difference with K+, this was due to
the digestibility of a ration that could be influenced by the composition of the ration, palatability, ambient temperature and digestion rate. Consumption of ration organic matter can increase following the increase in dry matter consumption because organic matter is the main constituent of dry matter [35].

According to [36] oxidative stress is an imbalance between the number of free radicals and the amount of antioxidants that is triggered by two general conditions, namely excess production of free radicals and lack of antioxidants. Factors that can affect the digestibility of feed include the nutritional value of feed, genetics, livestock health, stress and the environment [37]. The source of the emergence of oxidative stress is caused by an uncomfortable environment due to exposure to heat stress. The ability of flavonoids contained in sappan wood extract as an antioxidant can change or reduce free radicals and also as an anti-free radical. Flavonoids play a role in the digestive process by increasing the permeability of cell walls in the intestine and increasing nutrient absorption [38]. In contrast to [39] that infusion of ginger and mangosteen rind up to 5% could not increase the digestibility of organic matter in broiler chickens exposed to heat stress (p>0.05).

Table 2. Score mean and standard deviation of digestibility of organic materials of buck for each treatment.

| Kelompok Perlakuan                        | Digestibility of organic materials (%) |
|-------------------------------------------|----------------------------------------|
| K+ : Complete feed + heat stress          | 52.7807 ± 2.21073                      |
| K- : Complete feed                        | 56.2392 ± 2.65603                      |
| P1 : Complete feed + secang wood extract 100 mg/ kg feed + heat stress | 65.2609 ± 2.66215                      |
| P2 : Complete feed + secang wood extract 300 mg/kg pakan + heat stress | 65.0582 ± 1.51103                      |

a,b,c Different superscripts in the same raw show significant difference (p<0.05). K+ (complete feed + heat stress), K- (complete feed), P1 (complete feed + secang wood extract 100 mg/ kg feed + heat stress) and P2 (complete feed + extract of secang wood 300 mg / kg of feed + heat stress)

4. Conclusion
Giving a feed additive of sappan wood extract (Caesalpinia sappan L.) can reduce the feed conversion of male rabbits exposed to heat stress at a dose of 100 mg/kg feed and 300 mg/kg feed. Provision of a feed additive of sappan wood extract (Caesalpinia sappan L.) can increase the digestibility of organic matter in male rabbits exposed to heat stress at a dose of 100 mg/kg feed and 300 mg/kg feed.

5. References
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