Benefits of Sago pulp as litter material and its effect on the broilers performance

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Abstract. The study was aimed to determine the best combination of sago pulp and rice husk as litter material and its effect on the broiler performance including body weight, feed consumption, feed conversion ratio, and mortality rate. A total of 96 chicks were randomly assigned according to the Completely Randomized Design (CRD) with 4 treatments and 3 replications, and each replication consisting of 8 broilers. The treatments applied were litter with a combination of 0% Sago Pulp (SP) + 100% RH (Rice Husk); 25% SP + 75% RH; 50% SP + 50% RH; 75% SP + 25% RH, respectively. The measured parameters were weekly body weight, body weight gain, feed consumption, feed conversion ratio. The results showed that combination of SP and RH as litter material affect significantly weekly body weight gain, feed consumption, feed conversion ratio. The final body weight of chicken was highest on combination of 75%SP+25%RH (2316.67 g/bird), the highest feed consumption on combination of 0%SP+100%RH (2319 g/bird) and the lowest on 50%SP+50%RH (2298.5 g/bird), the most efficient feed conversion ratio on combination of 75%SP+25%RH (1.11). The results indicated that the best chicken performance was obtained from combination of 75%SP+25%RH as litter materials.

1. Introduction
Sago plants (Metroxylon sago) are native to Southeast Asia. The spread of this plant starts from West Melanesia to East India and from North Mindanao to the island of Java and the islands of the Southern Nusa Tenggara. Indonesia is a country that has the largest sago plant area in the world. Based on data from the development units of Papua and West Papua (Up4B), the development of the world sago land area reached 6.5 million ha in 2014. Of that land area, Indonesia has 5.5 million ha of sago trees, of which 5.2 million are in Papua and West Papua. In Merauke Regency, the potential for sago is very
large when compared to other regions in Papua. Sago forest in the Merauke area is the largest in Papua, with an area of 1,232,151 hectares or around 25.9% and the total area of sago forest in Papua which reaches 4,749,325 ha [1].

Almost all parts of the sago plant have benefits, for example, the trunk can be used as a pillar or bridge beam, the leaves as a roof, the stem as a wall of the house, even the pulp can be processed so that it becomes a selling point [2]. Sago pulp is quite potential to be used as the main ingredient in composting. This is because sago pulp is an organic material that is highly reactive to bio-activator compounds, thus increasing the organic matter content of sago pulp. The availability of sago waste produced has not been used optimally and is only allowed to accumulate in sago processing sites so that it can become environmental pollution, and until now only part of it has been used as animal feed [3].

The aim of using good litter material is to prevent the direct contact of the bird to the floor and to promote the absorption of faecal moisture [4]. Proper material on the floor of chicken house (litter) can provide comfort and increase productivity of broiler chicken during growout period, however its effects are related to its chemical and physical properties [5,6,7,8]. There are several types of litter materials that common uses for broilers production such as rice husks, wood shavings, rice straw, corn cobs and others. The main criteria of litter material i.e. easy to obtain, low prices, do not generate dust, and non-toxic [9].

One of the wastes from sago processing which is non-toxic and fulfills other requirements to be used as litter material is dry sago pulp. Wet bedding usually creates uncomfort condition in the broiler house due to the unconsumed feed and dropping of the chicken that were decomposed by microorganisms, and produce ammonia.

Currently, rice husk is the agricultural wastes and common material often used as litter material due to its abundance, cheaper prices, easier to obtained, and higher prices as manure compost. However, due to its poor ability to absorb water, rice husk litter becomes wet and impact to the chicken respiration system as well as to the chicken performance.

Merauke Regency has a huge sago potential compared to other regions in Papua. Sago pulp is a secondary product from the extraction of the starch of sago. The most abundance content of sago is sago pulp (81.5%) and the remaining is the sago starch (18.5%). Cellulose and lignin were the most common ingredient of sago pulp (20% and 21%, respectively) [10]. Based on the proportion between sago starch and sago pulp, it can be estimated how much waste is produced from the sago tree. The large amount of sago pulp, until now has not been used optimally, only allowed to accumulate in the location of sago flour processing which in turn caused environmental pollution.

Therefore, to reduce environmental pollution due to increasing sago production, the use of sago pulp as bedding material for broiler house needs to be studied. The objectives of the study was to determine the best combination of sago pulp and rice husk as litter material in the broiler house and its effect on the broiler performance.

2. Material and method

2.1. Bird management and research design
The research was conducted according to the completely randomized design with 4 treatments and 3 replication, each replication consist of 8 birds. A total of 96 (Wono-chick) 7th day-old broiler (initial weight 200 g) were assigned randomly to the wire pen (floor cage, 1 x 1 x 0.5 m) based on the treatments combination of sago pulp (SP) and rice husk (RH) as follows: 0%SP + 100%RH; 25%SP + 75%RH; 50%SP + 50%RH; 75%SP + 25%RH. Chicken were reared in a floored pen, open housing condition from d7 to 35 days (litter thickness 10 cm). Commercial feed, in crumble form, was provided gradually adjusted as follow: 40 g/b/d (d7-d13); 72 g/b/d (d14-d21); 100 g/b/d (d22-d28); 135 g/b/d (d29-d35). All chicken had access to water ad libitum during experiment. Chicks were weighed on d 7, 14, 21, 28, and 35, and body weight at d35 was referred as final body weight. Weekly body weight gain were also recorded and feed conversion ratio was determined. Mortality rate was calculated at the end of the of experiment as percentage of intial chicks number.
2.2. Data analysis
Data were subjected to the analysis of variance according to the Completely Randomized Design (4 treatment and 3 replication), and mean were tested for significance by the multiple range test [11]. Effect were considered statistically significant when P<0.05.

3. Results
In the present study, broiler chickens reared in the group of combination of 75% SP + 25%RH as litter material had the highest weekly body weight in comparison to the other combinations (table 1). The highest final body weight was also reached from the chicken that reared in the highest percentage use of sago pulp (75%) as litter material. The observed differences in body weight indicated that the broiler chickens were grew faster in the using of sago pulp in higher percentage as bedding material.

Table 1 shows the weekly weight gain, feed consumption, and feed conversion ratio of broiler chickens. Feed consumption of the chicken reared on the different litter combination of sago pulp and rice husk was almost similar. However, the highest growth rate was showed by the chicken that reared on the combination of 75% SP and 25% RH. The feed efficiency, which indicated by the feed conversion ratio value, was also better in the group chicken that reared in higher percentage of sago pulp as litter material.

Table 1. Chicken body weight (g/bird) reared on combination Sago Pulp and Rice Husk as litter material from d7 to d35

| Combination of litter material | Age of chicken |
|-------------------------------|---------------|
|                               | d14           | d21           | d28           | d35           |
| 0%SP+100%RH                   | 501.17 a      | 1050.42 a     | 1550.00 a     | 1933.38 a     |
| 25% SP+75%RH                  | 511.42b       | 1125.00b      | 1650.00b      | 2183.33 b     |
| 50%SP+50%RH                   | 512.29b       | 1150.00c      | 1800.00c      | 2233.33c      |
| 75%SP+25%RH                   | 556.67c       | 1226.67d      | 1833.33d      | 2316.67d      |

Caption: abcdDifferent superscripts following the value in the same column indicate significantly different (P<0.05) SP: Sago pulp, RH: Rice husk

Table 2. Average body weight gain, feed consumption and feed conversion ratio of broiler reared on combination Sago Pulp and Rice Husk as litter material from d7 to d35

| Combination of litter material | Weight Gain (g/b) | Feed Consumption (g/b) | Feed Conversion Ratio (FCR) |
|-------------------------------|------------------|------------------------|----------------------------|
| 0%SP+100%RH                   | 1726.00          | 2319.28                | 1.34                       |
| 25%SP+75%RH                   | 1968.11          | 2308.28                | 1.20                       |
| 50%SP+50%RH                   | 2020.83          | 2298.50                | 1.14                       |
| 75%SP+25%RH                   | 2084.79          | 2303.97                | 1.11                       |

Caption: SP: Sago pulp, RH: Rice husk

4. Discussion
Data shows that the broiler chicken had the growth rate and feed efficiency better on the rearing house using the sago pulp as bedding material in the highest percentage (75%) in comparison to the other treatments. The differences of the performance of the broiler in the present study indicated that the use of sago pulp as bedding material produce to the proper micro-environment for the chickens during growout. The results of the present study were in agreement with the finding of the [12] and [13] that the rice hulls had significantly lower body weight compared to the sand, wood shaving, and recycled paper roll as bedding materials. Contrarily, the finding of other researchers was showed insignificant different result the use of the alternative bedding material on the body weight or other performance parameters of the broilers [5, 6, 8, 14, 15,16].
During the growout of the broiler chicken, especially in the last week of the experiment, the heavier of the chicken, the more dropping they produce, and the bedding become wet quickly. Therefore, litter management including litter additions was conducted every 3 days to provide the comfort environment to the chicken as indicated by chicken behavior [12,16].

Although birds performance is the best indicators to evaluate the bedding materials, availability and cost are the two main factors that have a big impact when deciding the use of the newer materials [5]. Sago pulp, wastes produced by the sago flour processing, were abundant in Merauke Regency, and on the other hand, have the potential to become a pollutant to the environment. Therefore, the use of sago pulp as litter materials in order to substitute the rice husk would beneficial to the broiler farmers.

Such properties of litter material as particle size, bulk density, thermal conductivity, and compressibility as proposed by [6] were the other criteria that need to further investigation in the use of the sago pulp in broiler houses especially in the tropical region in Papua island.

5. Conclusion

The final body weight of chicken was highest on combination of 75%SP+25%RH (2316.67 g/bird), the highest feed consumption on combination of 0%SP+100%RH (2319 g/bird) and the lowest on 50%SP+50%RH (2298.5 g/bird), the most efficient feed conversion ratio on combination of 75%SP+25%RH (1.11). The results indicated that the best chicken performance was obtained from combination of 75%SP+25%RH as litter materials. It is recommended for broiler entrepreneurs to utilize sago waste as litter material not only to reduce environmental pollution, but it can be also used to improve the broiler performance.

References
[1] Djoeffeir, HMHB, Herodian S, Ngadiono TA and Amarilis S 2014 Sagu untuk Kesejahteraan Masyarakat Papua. Suatu kajian dalam upaya pengembangan sagu sebagai komoditas unggulan di provinsi Papua dan Papua Barat
[2] Flach M 1977 Yield Potential of the Sago Palm and its Realisation Paper of the International Sago Symposium in Kuching Tan. Univ. of Malaysia. p.157-177
[3] Sangaji I 2009 Mengoptimalkan Pemanfaatan Ampas Sagu Sebagai Pakan Melalui Biofermentasi Dengan Jamur (Pleurotus ostreatus) dan Amonia Dissertation (Bogor: IPB)
[4] Garcia RG, Almeidda Pas ICL, Caldara FR, Naas IA, Pereira DF, Freitas LW, Schwingel AW, Lima NDS, Graciano JD 2010 Br J. Poult. Sci. 12(3) 165-169.
[5] Grimes JL, Carter TA, and Godwin JL 2006 Poult. Sci. 85 563–568
[6] Atapattu NSBM and Wickramasinghe KP 2007 Poult. Sci. 86 968–972
[7] Farhadi D 2014 Glob. J. Anim. Sci. Res. 2(3) 270-276.
[8] Sigroha R, Bidhan DS, Yadav DC, Sihag SS and Malik AK 2017 J. Anim. Res. 7(4) 665-671
[9] Tiwimetasari 2014 Pengaruh Berbagai Jenis Bahan Litter Terhadap Kualitas Litter Broiler Fase Finisher di Closed House Essay (Bandar Lampung: Department of Animal Husbandry, Faculty of Agriculture, Bandar Lampung University)
[10] Tirta P W W K, Indrianti N, and Ekaifti R 2013 Potensi tanaman sagu (Metroxylon sp.) dalam mendukung ketahanan pangan di Indonesia
[11] Steel RGD and Torrie JH 1995 Principles and Procedures of Statistics Alih Bahasa Sumantri, B. Prinsip dan Prosedur Statistika. Edisi 4 (Jakarta: Penerbit PT Gramedia Pustaka Utama)
[12] Toghyani M, Gheisari A, Modaresi M, Tabeidian SA, Toghyani M 2010 Appl. Anim. Behaviour Sci. 122 (2010) 48–52 5
[13] Mahmoud MSH, Soliman FNK, Bahie-El-Deen M and El-Sebai AA 2014 Res. J. Poult. Sci. 7(1): 1-6.
[14] Davis JD, Purswell JL, Columbus EP, and Kiess AS 2010 Int. J. Poult. Sci. 9(1); 39–42, 2010
[15] Sharma G, Khan A, Singh S, Anand AK 2015 Veterinary World 8(10): 1219–1224
[16] Tri Haryanto S, Khaira N B, and Septinova D 2015 Hidup, Karkas, Giblet, Dan Lemak Abdominal Broiler Fase Finisher Di Closed House Jurnal Ilmiah Peternakan Terpadu 3(1) 38-44