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Production and Nutrient Quality of Rice Straw of Local Rice Varieties from South Kalimantan

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ABSTRACT

A survey and laboratory study was conducted to estimate rice straw production of local rice varieties from South Kalimantan. Two local rice varities (Siam Adil and Pandak) cultivated in a tydal swamp paddy field in Tanah Laut regency were harvested at same time to estimate the dry matter production of rice straws and to obtain the rice straws samples. Rice straws samples were analysed to determine the percentage of botanical parts and nutrient contents, including the contents of dry matter, organic matter, crude protein, and crude fiber. Results showed Siam Adil rice straw had lower percentage of leaf but had higher percentage of stem compare to Pandak. The botanical fraction of Pandak was similar to the improved rice variety (Ciherang). Siam Adil produced higher rice straw dry matter (7.95 tonnes/ha) compare to Pandak (5.83 tonnes/ha). There were no significant differences in the contents of dry matter, crude protein, and crude fibre of both local varieties. However, local rice straws had lower crude protein and higher crude fiber contents compared to the improved rice straw. In conclusion, local rice varieties potentially produced higher rice straw biomass but had lower nutrient quality. Thus, a pretreatment is necessary to improve utilization of local rice straw as a ruminant feed.

Keywords: local rice variety, rice straw, rice straw quality, ruminant feed, South Kalimantan.

1. Introduction

Rice straw is a by product of rice production and produced abundantly in rice-producing countries, such as Indonesia. According to annual rice grain production, Indonesia was in the 3rd rank of rice straw producer in the world, which produced 23.33 million tonnes of rice straw (Sarnklong et al., 2010). In many developing countries, rice straw is commonly used as ruminant feed, especially during long dry season when native grass production is inadequate (Devendra, 1997).

South Kalimantan (Kalsel) is one of important rice-producing province in Indonesia. Rice harvested area in Kalsel was estimated 549,988 ha that produced 2.45 million tonnes of rice grain (BPS Kalsel, 2018). However, almost 80% of this rice harvested area is cultivated with local rice varieties that have longer maturity length (6 months) compare to the improved varieties (3 months). As population increase, the land will be used more intesively and extensively for food production to meet population demand on food consumption. As consequence, land availability for pasture production will be decreased and ruminant production will rely on feeding agricultural by products, mainly on rice straw. However, study on the production of rice straw of local varieties from South Kalimantan is scarce, as well as observation on its nutrient quality.

Therefore, it is necessary for conducting a study to estimate rice straw production from local rice varieties in Kalsel and to determine its nutrient quality as ruminant feed. Results will describe the

potential of rice straw as under-utilized feed resources to support livestock production in South Kalimantan.

2. Materials and Methods

Survey was conducted in Panyipatan sub dictrict, Tanah Laut district, South Kalimantan province at August 2019. Rice was cultivated in a non irrigated paddy field, in a swamp area, and fertlized with urea and phosphor fertilizers at dose 500 kg/ha. Observation and sampling were conducted immediately after harvest.

Estimation of rice straw production was carried out using a destructive sampling method that used a 1 x 1 m^2 quadrant at 6 points in each sampling spot. Rice straw was cut at 5 - 10 cm above the ground. Then, rice straw was weighed per quadrant to obtain fresh weight production per meter square. Fresh rice straw production per hectare then estimated by multiplying the weight with 10,000. Dry matter production per hectare was estimated by multiplying the fresh rice straw production per hectare with dry matter percentage of the sample. Botanical fractions of rice straw tillers were determined according to Nori *et al*. (2006). Samples were collected for nutrients content analysis using proximat analysis according to AOAC (2016). Data were analyzed statistically using independent student-t analysis to compare the rice straw productions and its chemical composition. Statistical analysis was carried out using SPPS software (IBM Corp., USA).

3. Results and Discussion

Botanical Fraction

Length of maturity influences the percentage of botanical fraction of cereals plant. Study of Wang *et al*. (2006) showed leaf fraction was decreased by longer harvesting date, while stem fraction was increased. Changing in botanical fractions would affect the chemical composition and nutritive value of rice straw, especially the crude protein content that will be decreased but the fibre fraction and lignin contents were increased.

Table 1. Botanical fraction of local rice varieties from South Kalimantan

	Botanical Fraction (%)		
Rice Variety	Inflorescense^{ns}	Stem^{ns}	Leaf^{ns}
Siam Adil	21.28	52.24	26.49
Pandak	20.13	48.17	31.74
Ciherang*	20.40	47.60	32.00

^{ns} Means were not significantly different (P>0.05)

*Improved cultivar (Dahlia, 2019)

This study showed botanical fractions of both local varieties were not significantly different. However, Siam Adil rice straw had lower leaf fraction compare to Pandak rice straw, but the stem fraction of Siam Adil rice straw was higher than Pandak rice straw. Leaf and stem fractions of Pandak rice straw were similar to the botanical fractions of an improved rice variety rice straw that used as reference in this study, namely Ciherang (Tabel 1).

Higher leaf fraction might have effects on rice straw digestibilty and palatability. Devendra (1997) stated morphological characteristics determined rice straw intake and digestibilty. Among these caharacteristics were the proportion of plant parts, chemical composition, and the distribution of these chemical components in the plant parts. In example, silica can be highly found in the stem of rice straw and the presence of silica reduces the palatability and degradability of rice straw. Sarnklong *et al.* (2010) emphasized that rice straw contains a relatively high proportion of leaf (60%), compared to other cereal straws such as barley (35%), oats (43%) and wheat (20-41%). Leaves of rice straw contained less cell wall fractions than the stems, but more ash and acid-insoluble ash, resulting in a lower *in vitro* dry matter digestibility of the leaves (50-51%) compared to the stems (61%).

Nutrient Quality of Local Rice Straw

Eventhough ruminant requires low protein level in the diet, higher protein levels would improve cattle performance, such as a higher average daily gain or milk production (Wanapat *et al*., 2013). Feeding rice straw only does not provide enough nutrient for optimum animal production because rice straw has low nutritive value that indicated by low crude protein content (2-5%), high lignin and fiber content (cell wall fraction > 50%), and low digestibility (Wanapat *et al*., 1985).

Table 2. Chemical composition of rice straw of local rice varieties from South Kalimantan

Rice Variety	Chemical Composition (%)			
	Dry Matter^{ns}	Organic Matter^{ns}	Crude Protein^{ns}	Crude Fiber^{ns}
Siam Adil	32.94	81.72	5.97	38.48
Pandak	33.98	81.93	5.98	38.17
Ciherang*	62.47	84.15	9.02	35.05

^{ns} Means were not significantly different (P>0.05)

*Improved rice cultivar (Dahlia, 2019)

In this study, rice straws of both local rice varieties contained relatively low crude protein content (5.9%) compared to the improved rice cultivar (9.02%). Local rice varieties which were cultivated in tydal swamp area had longer maturity length compare to the improved variety. Local rice variety of Kalsel usually need 180 days from planting to harvesting (Wahdah and Langai, 2009), while improved rice variety only need 90-100 days (Basuni *et al*., 2010). Longer maturity lenght affected on more lignification of cell wall and less protein content of the plant (Wang *et al*., 2006). Nitrogen fertilization levels were found increase the crude protein of whole rice straw, but did not have significant effects on fiber fractions contents (Nori *et al*., 2006).

Local Rice Straw Production

Rice breeding has generally focussed only on improving the agronomic characteristic of rice variety, such as grain yield and its quality. Unfortunately, the research did not pay attention to the rice straw yield and quality. Study of Azis *et al*. (2014) showed rice straw production of Ciherang in Lampung was 13 tonnes/ha of fresh rice straw or equal to 3,94 tonnes/ha of dry matter. Compare to this study, local rice varieties of Kalsel potentially produced higher rice straw than improved rice variety (Ciherang), whereas fresh rice straw, dry matter, and organic matter productions of Siam Adil were higher than Pandak (Table 3).

Table 3. Biomass production of rice straw of local rice varieties from South Kalimantan

Rice Variety	Rice Straw Production (ton/ha)		
	Fresh/as fed**	Dry Matter*	Organic Matter*
Siam Adil	24.09	7.97	6.52
Pandak	17.18	5.83	4.78

* Means were significantly different (P<0.05)

** Meand were very significantly different (P<001)

Dry matter was a characteristic of genotypes and also influenced by environmental factor, mainly Nitrogen fertilization (Fageria and Baligar, 2005). Dry matter production of the plant will rise corresponding with additional of N applied. Research of Nori *et al*. (2006) showed increasing N fertilization could increase the crude protein content of rice straw, eventhough this did not affect on dry matter disgestibility and eventually it decreased organic matter digestibility.

In this study, farmer used 250 kg Nitrogen and Phosphor fertilizers in ratio of 1:2. These fertilizers doses were lower compare to fertilizer dose for improved cultivar. According to Basuni *et al*. (2010), the common dose for improved rice variety, such as Ciherang, was 300-400 kg/ha for urea, 100-150 kg/ha for SP-36, and 100-150 kg/ha for KCl. Wahdah and Langai (2009) in their study showed that in tydal swamp area of Kalsel, only 70% of farmer planting local rice applied fertilizer into the paddy field. This fertilizer mainly composed of urea and phospor with ratio 1:2

4. Conclusions

This study indicated that local rice varieties of Kalsel potentially produced higher rice straw biomass compared to the improved rice variety. However, both observed local rice varieties had lower nutrient quality. Therefore, a pretreatment is necessary to improve the nutrient quality of local rice straw for ruminant feeding.

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