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# Nutritional Quality of Pakchong, Zanzibar and Bio Grass Harvested at Different Ages

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***Abstract***

*The study is intended to know the interaction between grass and cut age on the quality of grass, and knowing the type of grass and cut age best nutrients by the first - stage design method of grouping (R), a grass of the first factors (R), the grass of Zanzibar (R2), the biograss (R3), the second factor (U) of cut age: 50 days (U1), 60 days (U2), and 70 days (U3) with 3 deuteronomy. The data obtained from the results of this study were analyzed with varied analysis. If it shows a significant effect (p <0.05), then to find out which treatment is different, it will be continued using the multiple distance test from Duncan. Studies have shown that there is real interaction (P <0.05) to very real (P < 0.01) between grass types and the age cut to nutrients such as water, ash, organic matter, rough protein, and rough fibers except that of coarse fat. The nutritional qualities of grass and the highest longevity of grasses and water content are produced from biograss grass at 50 days of age (R3U1), the highest ash content produced by zansibar grass with 60 days of grass And the highest concentration of crude fats from 50 days of living pakchong (R1U1) grass.*

Key words : Nutrition quality, grass, harvested day

## 1. Introduction

The program that increases grass population cannot be released by the increase in quality and quantity of food. It has good qualities if it provides proper nutritional needs, good, kind, amount, and resistance to nutrients so that the metabolic processes that occur within the animal's body are complete. One of the principal foods for farm animals that can help to increase farm production is that of green feed. Besides to help increase production in livestock, it needs to be supported by the availability of adequate and continuous forage feed [1].

In the world of animal husbandry, especially ruminant livestock cultivation will not be separated from matters relating to the grass. For ruminant livestock in particular, this forage has the highest percentage in production costs, which is around 70%. Types of grass are also very varied, some of which are elephant grass, pakchong, zanzibar and Agrinak bio grass. The advantages of Pakchong grass as animal feed are as Pakchong grass protein content is higher than odot grass (11.6 %), Taiwan grass (13%), while Pakchong grass has a protein content of 16.45 % [2]. The highest productivity of Pakchong grass among the grass known to the breeders so far is that it can reach 1500 tons/ha/year, while ODOT grass is only able to produce 350 tons/ha/year and Taiwan grass is around 400 tons/ha/year. Although scientific grass Pakchong has the same species type as Napier India and Napier Taiwan, but among the three types, Napier Pakchong is considered by breeders as the most capable type to produce food directly for their livestock. The hallmark of Pakchong grass is a long life where growth can reach the age of 9 years and can be harvested every 40 to 50 days. This grass only needs to be watered once a week during the rainy season. In addition, this Pakchong grass does not have

thorns so that it can make it easier for farmers when harvesting.

Next is the type of zanzibar grass has a higher stem structure when compared to other types of grass. Contains high nutrition for livestock, especially cows. Zanzibar grass contains nutrients including 12.93% dry material, 19.43% protein, 9.09% carbohydrates, and 31.33% crude fiber [3]. And the last is that Taiwan elephant grass can be given in fresh form, or can also be processed into silage and hay if the conditions are abundant during the rainy season as a reserve of food ingredients during the dry season [4]. Taiwanese elephant grass contains coarse protein nutrition 10.85%, crude fiber 30-32% and Ca 0.24% -0.31% [5]. Research Results [6] concerning the introduction of several types of grass and Introduction of Several Types of Grass and Leguminosa Superior as forage feed shows the highest forage and dry forage production, namely the Taiwan variety elephant grass so that the cultivar is used as a genetic material induction of mutation in this study to obtain a new generation the elephant grass.

In general, harvesting elephant grass is at the age of 40 days or before the growth of flowers. If it passes through this age, the plant has produced flowers so that the stem will become hard. The nutritional value contained in grass that is too old has also declined. The harvesting process can be done by cutting the lowest segment of the elephant grass leaving only as high as 5-10 cm [7].

The harvesting of elephant grass (*Pennisetum Purpureum* cv Thailand) was first carried out at the age of 3 months after planting, then the next harvest at 60-70 days intervals. Meanwhile, according to [8], *Pennisetum Purpureum* cv Thailand can be harvested with a cut interval every 45 days. The stem is cut close to the ground, and in a short time, the new shoots or Ratoon will come out. Cutting interval (harvest) has a variety of effects on production and quality of Elephant grass. High frequency (harvest) can reduce growth and development, while low interval frequencies will cause fiber accumulation and decreased quality [9]. This is because elephant grass has high cell wall structures carbohydrates and can increase rapidly with its age, causing a decrease in the concentration of crude protein (CP) and its digestibility [10]. Zanzibar grass harvested at the age of 50 days shows the best quality because the crude protein content produced is the highest at 20.66% and the crude fiber content produced is at least 19.48%.

## 2. Material and Methods

### 2.1. Place and time Research

This research was conducted at Breeding Center Pulukan BPTU-HPT Pangyangan Village, Pekutatan District, Jembrana Regency, Bali Province from 7 December 2021 to 10 May 2022.

### 2.2. Experimental design

Cutting intervals greatly affect the nutritional quality of elephant grass. The slower the plants are cut, the nutritional value will decrease because a lot of nutrients are lost to be converted into flowers, fruit, or seeds and the stems harden. According to [11], elephant grass can be cut every 40 days during the rainy season and 60 days during the dry season. According to [12], the grass type Pennisetum purpureum cv. Thailand can be harvested with an interval of 45 days. Based on the results of the study, in this study grass was cut at the age of 50, 60 and 70 days.

This research was conducted using a random design group (rack) factorial pattern with two factors. The first factor is the type of grass (R), namely Pakchong grass (R1), Zanzibar grass (R2), Bio Grass (R3) grass. The second factor is the age of cut (U), namely the age of 50 days (U1), the age of 60 days (U2), and the age of 70 days (U3). The experiment was carried out with 3 groups so that 9 combinations of treatment were obtained. The combination of treatment are Pakchong grass is 50 days old (R1 U1), Pakchong grass is cut 60 days (R1 U2), Pakchong grass in the age of 70 days (R1 U3), Zanzibar grass that is cut into 50 days (R2 U1), Zanzibar grass is 60 days old (R2 U2), Zanzibar grass in the age of 70 days (R2 U3), Agrinak Biograss is cut over 50 days (R3 U1), Agrinak Biograss is

cut over 60 days (R3 U2) dan Agrinak Biograss is cut over 70 days (R3 U3).

### 2.3. Materials and tools

Materials used include Pakchong grass, Zanzibar grass, and Agrinak Bio Grass grass cuttings, Organic fertilizer and urea fertilizer, Water, Soil The tools used in this study include pH meter, Scales, Polybag size 1 kg, meter, shovel, hoe, Cytht, Bucket, Gayung, Plastic, Stationery, Camera

### 2.4. Research Implementation

Prepare a land area of 4.24 acres after that the land processing is carried out and made plots. Plots measuring 1.80 m x 180 m cm, as many as 27 plots with a distance of 1 m and every 1 plot is made 9 holes with a size of 10 cm x 10 cm. The first fertilization is done at the time of soil treatment with organic fertilizer (manure) and Urea fertilizer with the same dose, namely organic fertilizer 3 tons/hectare/year and urea fertilizer 60kg/hectare/year. The age of the stem/cuttings used as seeds is chosen quite old for about 3 months. The seeds to be planted in the form of cuttings along 3 rod segments. The recommended grass planting distance is 60 cm x 60 cm with the position of the stem plugged in a tilted 30° to facilitate the growth of roots. After that watering grass dan care of grass (seeding).

### 2.5. Harvesting and Sampling

Cutting is done by leaving 10 cm of the bottom of the plant. If the rest of the plants are too short, the plants will be difficult to have a hardy. However, if the rest of the plant is too long then only the buds are growing and the number of tillers will not develop. In addition, if left too long and not immediately cut then the grass will start flowering and the stem hardens. This must be avoided because it can reduce the nutritional value of the grass to be consumed by livestock [11].

### 2.6. Data Analysis

The data obtained from the results of this study were analyzed with varied analysis. If it shows a significant effect ($p < 0.05$), then to find out which treatment is different, it will be continued using the multiple distance test from Duncan [13].

## 3. Results and Discussion

### 3.1. Research result

The results of statistical analysis show that there is an interaction between the type of grass and the age of the cut in the variable water content, ash content, organic matter, and crude protein content. But there is no interaction in the variables of crude fat content. Significance of Nutrition Quality Variable Types of Grass and Different Cut Age can be seen in Table 1

Table 1.
The significance of the quality of the grass type of nutrition in different cuts

| Observation Variable | Treatment | | |
|---|---|---|---|
| | Type of Grass | Cutting | Interaction |
| Water content (%) | ** | ** | ** |
| ash content (%) | ** | ** | ** |
| Organic material (%) | ** | ** | ** |
| Coarse protein content (%) | ** | ** | ** |
| Rough fiber content (%) | ns | ns | * |
| Coarse fat content (%) | ns | ** | ns |

Description :
ns = unreal effect ($p > 0.05$),
* = significant effect ($p < 0.05$)
** = very significant effect ($p < 0.01$)

#### 3.1.1 . Water Content

The results of the analysis of the variety as shown in Table 1. shows the interaction between the type of grass and the age of the cut is a very significant effect ($p < 0.05$) on the grass water content. The highest water content was obtained in the combination of the treatment of bio grass grass type which was cut at the age of 50 days (R3U1) which was 89.98%. These results are significantly different ($p < 0.05$) compared to the water content of the combination of R1U2 treatment (88.43%), R1U1 (87.93%), R3U2 (87.92%), and very significantly different (p <0 , 01) Compared to the combination of R1U3 treatment (87.21%) and R3U3 (86.35%). Furthermore, when compared to the combination of R2U2 treatment (89.44%), R2U3 (89.26%) and R2U1 (89.18%) are not significantly different (P> 0.05).

Table 2.
Nutritional Quality Types of Grass in Different Cut Age

| Treatment Combination1) | Observation Variable | | | | | |
|---|---|---|---|---|---|---|
| | Water content (%) | ash content (%) | Organic material (%) | Coarse protein content (%) | Rough fiber content (%) | Coarse fat content (%) |
| $R_1U_1$ | 87,93$^{bc2)}$ | 15,58$^{a}$ | 84,42$^{bc}$ | 12,44$^{a}$ | 25,27$^{c}$ | 3,69$^{c}$ |
| $R_1U_2$ | 88,43$^{bc}$ | 16,67$^{ab}$ | 83,33$^{bc}$ | 17,41$^{c}$ | 21,13$^{ab}$ | 3,65$^{b}$ |
| $R_1U_3$ | 87,21$^{ab}$ | 16,99$^{ab}$ | 83,01$^{bc}$ | 14,73$^{b}$ | 23,16$^{bc}$ | 2,40$^{c}$ |
| $R_2U_1$ | 89,18$^{cd}$ | 16,08$^{ab}$ | 83,92$^{bc}$ | 20,66$^{d}$ | 19,48$^{a}$ | 3,07$^{c}$ |
| $R_2U_2$ | 89,44$^{cd}$ | 20,11$^{c}$ | 79,89$^{a}$ | 18,96$^{cd}$ | 23,45$^{bc}$ | 3,53$^{b}$ |
| $R_2U_3$ | 89,26$^{cd}$ | 17,32$^{b}$ | 82,68$^{b}$ | 12,79$^{ab}$ | 22,23$^{abc}$ | 1,91$^{a}$ |
| $R_3U_1$ | 89,98$^{d}$ | 15,90$^{ab}$ | 84,10$^{bc}$ | 12,79$^{ab}$ | 22,68$^{abc}$ | 3,13$^{c}$ |
| $R_3U_2$ | 87,92bc | 15,91$^{ab}$ | 84,09$^{bc}$ | 17,07$^{c}$ | 23,85$^{bc}$ | 2,32$^{b}$ |
| $R_3U_3$ | 86,35$^{a}$ | 15,47$^{a}$ | 84,53$^{c}$ | 13,66$^{ab}$ | 23,32$^{bc}$ | 2,22$^{a}$ |
| SEM$^{3)}$ | 0,47 | 0,51 | 0,53 | 0,62 | 1,09 | 0,32 |

Description :

1. - R1 U1 = Pakchong grass is 50 days old.
   - R1 U2 = Pakchong grass is cut 60 days.
   - R1 U3 = Pakchong grass in the age of 70 days.
   - R2 U1 = Zanzibar grass that is cut into 50 days.
   - R2 U2 = Zanzibar grass is 60 days old.
   - R2 U3 = Zanzibar grass in the age of 70 days.
   - R3 U1 = Agrinak Biograss is cut over 50 days.
   - R3 U2 = Agrinak Biograss is cut over 60 days.
   - R3 U3 = Agrinak Biograss is cut over 70 days.
2. The value of the number followed by a different superscript letter in the same column shows a real difference ($p < 0.05$) to the very real ($p < 0.01$).
3. SEM (Standard Error of The Treatment Means).

### 3.1.2 Ash Content

The results of analysis of variance as shown in Table 1 show that the interaction between grass type and cutting age had a very significant effect ($P<0.01$) on grass ash content. Table 2 showed that the highest ash content was found in Zanzibar grass which was cut at the age of 60 days (R2U2), namely 20.11%. The results obtained were highly significant ($P<0.01$) compared to all treatment combinations. Furthermore, the ash content of the R2U3 treatment combination (17.32%) was significantly different ($P<0.05$) compared to the ash content of the R1U1 treatment combination (15.58%) and R3U3 (15.47%), but not significantly different ($P> 0.05$) compared to the combination of treatments R1U3, R1U2, R2U1, R3U2, and R3U1.

### 3.1.3 Organic Materials

The results of the analysis of variance showed that the interaction between grass type treatment and cutting age had a very significant ($P<0.01$) effect on grass organic matter (Table 1). The highest organic matter was obtained from the grass type Bio Grass at the age of 70 days ($R_3U_3$) is 84.53%. The results obtained were significantly different ($P<0.05$) compared to all treatment combinations.

Furthermore, the organic matter combination treatment ($R_2U_3$) (82.68%) significantly different ($P<0.01$) compared to the organic matter treatment $R_2U_2$ (79,89%) and $R_3U_3$ (84.53%), but not significantly different ($P>0.05$) compared to the treatment combination $R_1U_1$, $R_3U_1$,$R_3U_2$, $R_2U_1$ and $R_1U_2$,

**3.1.4 Crude Protein Content**

Analysis of variance showed that the interaction between grass type and cutting age had a very significant effect ($P<0.01$) on grass crude protein content (Table 1). The highest crude protein content was found in Zanzibar grass at 50 days of cutting ($R_2U_1$) is 20.66%. The results obtained were highly significant ($P<0.01$) compared to the R treatment combination $R_1U_2$, $R_3U_1$, $R_3U_2$, $R_1U_3$, $R_3U_3$, $R_2U_3$, and $R_1U_1$

**3.1.5 Crude Fiber Rate**

The results of the analysis of variance are shown in Table 1. showed that the interaction between the type of grass and the age of the cut had a significant effect ($P<0.05$) on the crude fiber content of the grass. The highest crude fiber content was obtained from Pakchong grass at the age of 50 days of cutting $R_1U_1$ namely (25.27%). The results obtained were significantly different ($P<0.05$) compared to all treatment combinations. Furthermore, the crude fiber content of the combination treatment of $R_1U_2$ (21.13%) differed significantly ($P<0.01$) compared to the R treatment$_2$IN$_1$ (19.48%), but not significantly different ($P>0.05$) compared to the treatment combination $R_3U_2$, $R_2U_2$,$R_3U_3$, $R_1U_3$, $R_3U_1$ and $R_2U_3$. Table of crude fiber content in different grass types and cutting ages can be seen in Table 3.2.

**3.1.6 Crude fat rate (%)**

Results of analysis of variance as shown in Table 1. showed that the interaction between grass type and cutting age had no significant effect ($P<0.01$) on grass crude fat content. Cutting age had a very significant effect ($P<0.01$) on grass crude fat content, while grass type had no significant effect ($P>0.50$). The crude fat content of the cut grass at the age of 50 days ($U_1$) of 3.30% and 60 days ($U_2$) of 3.17% significantly different compared to the U treatment$_3$ (2.18%). Furthermore, between treatments $U_1$ Day $U_2$ statistically not significantly different ($P>0.05$) can be seen in Table 3.

Table 3
Crude Fat Content of Mowed Grass at Different Ages

| Cut Over Treatment | Crude fat (%) | SEM[2)] |
|---|---|---|
| Cut over 50 days ($U_1$) | 3.30[b1)] | |
| Cut over 60 days ($U_2$) | 3.17[b] | 0,51 |
| Cut over 70 days ($U_3$) | 2.18[a] | |

Description:

[1)] A numeric value followed by a letter*super script*different in the same column showed significant ($P<0.05$) to very significant ($P<0.01$) differences

[2)] SEM =*Standar Error of Treatment Means*

**3.2. Discussion**

The program to increase the ruminant livestock population cannot be separated from increasing the quality and quantity of feed. Forage quality is determined by plant species, soil fertility, microclimate (light, rainfall, temperature and humidity), cutting age, fertilization and tillage. These factors can determine the production and also the nutrient content of the forage. Harvesting the right forage crops at certain time intervals is an important factor. The older the cutting age, the higher the production but inversely proportional to the nutritional quality (the crude fiber content increases, the crude protein decreases). The quality of forage nutrition can affect the level of digestibility in livestock. The increase in cutting age is also accompanied by an increase in the production of leaves, twigs and total plants. [14] stated that forage plants which were cut at a longer age were able to produce higher

forage and food reserves for more growth. However, the longer the plants are cut when the plants are flowering, the fresh production will not be maximized. [15] argues that the plant will not enter the reproductive period if the vegetative growth has not been completed and has not reached the mature stage for flowering. Therefore, it is important to know the optimal cutting age for different types of grass to obtain optimal nutritional qualities such as moisture content, ash content, fat content, protein content, crude fiber and organic matter.

Based on the research results, the highest water content was found in the type of Bio grass which was cut at the age of 50 days ($R_3IN_1$) with water content (89.98%) and the lowest water content was obtained in the Bio grass type that was cut at the age of 70 days ($R_3IN_3$) that is equal to (86.35%). The results showed that the water content in plants decreased with increasing cutting age. This condition occurs because young plants have active cells, while older plants thicken the cell walls resulting in increased dry matter content. The older the plant, the less water content and the proportion of the cell wall is higher than the cell contents [16]. [17] states that plants at a young age are of better quality because the crude fiber is lower, while the protein content is higher. The longer the harvest age of the plant, the higher the crude fiber content, otherwise too early or harvested at a short age, the forage will always be young so that the protein content and water content are high but the fiber content is low. Older plants thicken the cell walls resulting in increased dry matter content. The higher the age of the plant, the higher the cell wall components of a forage [18].

Based on the research results, the treatment of grass types, cutting age and their interactions had a very significant effect ($P<0.01$) on grass ash content. The highest ash content was obtained from Zanzibar grass which was cut at 60 days of cutting ($R_2U_2$) which is equal to (20.11%) and the lowest ash content obtained on the Pakchong grass type that was cut at the age of 50 days $R_1U_1$ that is equal to 15.58%. Pakchong, Zanzibar and Bio grass types have different moisture content. This is probably because morphologically, each plant has a root system with relatively different ratios to above-ground biomass, so that the nutrient absorption capacity of the soil is relative to dry matter accumulation. As a result, the levels of minerals accumulated in the ash are different [19]. Treatment of cutting age affects the ash content because older cutting age can reduce the water content thereby increasing the percentage of ash content in the material [20]. [21] also stated that the increase in ash content was due to the older the cutting age of the plant, the lignification process of the plant would be higher so that the components of inorganic material which would be counted as ash would increase.

Based on the research results, the treatment of grass types, cutting age and their interactions had a very significant ($P<0.01$) effect on grass organic matter. The lowest organic matter was obtained from Zanzibar grass which was cut at the age of 60 days ($R_2U_2$) which was 79.89% and the highest organic matter was obtained from Bio Grass which was cut at the age of 70 days ($R_3U_3$) that is equal to 84.53%. Based on the results of the study, the same type of grass tends to have an insignificantly different organic matter content at different cutting ages. Each type of grass has a different organic matter content because the metabolic system in each individual plant is different. The decrease or increase in organic matter content in plants is due to the increasing ash or inorganic matter content decreased or increased. According to [22], the longer the plants are not cut, the longer the leaves will carry out the photosynthesis process so as to increase the production of simple sugars which result in increased organic matter content. [23] states that the results of photosynthesis in the form of crude protein, fat, BETN and fiber are complex compounds of organic matter components.

Based on the results of the study, the treatment of grass types, cutting age and their interactions had a very significant effect ($P<0.01$) on grass crude protein content. The highest crude protein content was obtained from Zanzibar grass which was cut at the age of 50 days ($R_1U_1$) that is equal to 20.66%. The three types of grass have different crude protein content. Based on the research results, the same type of grass has different levels of crude protein at different cutting ages. The longer the cutting age, the lower the crude protein content tends to occur in the three types of grass observed. The older the

plant, the stem and flower production increases, but leaf production decreases, this affects the protein content of the plant. According to [20], if the cutting interval is extended there will be a decrease in the crude protein content. The decrease in crude protein content was not only due to the age of the plant, but also due to a decrease in the proportion of the leaf blade with petals and stems, where the protein content of the leaf blade was higher than the petals and stem parts.

The results showed that the interaction between grass type treatment and cutting age had a significant ($P<0.05$) effect on grass crude fiber content. The highest crude fiber content was obtained from the cut Pakchong grass at the age of 50 days ($R_2IN_1$) that is equal to 25.27%. The results showed that the three types of grass had different crude fiber content. Judging from the cutting age, the same type of grass has an increased crude fiber content at a longer cutting age. This is due to the fact that the older the plant, the higher the cell wall content, thereby increasing the crude fiber of the plant. This is supported by [24] which stated that the content of the fiber fraction in mulberry plants continued to increase with the length of cutting age. Therefore, the older the plant, the higher the fiber content. In connection with the development of maturity (plant age) forage, there will also be an increase in the concentration of fiber.

Based on the results of the study, the interaction between grass species and age had no significant effect ($P>0.05$) on grass crude fat content. However, the age of grass cutting had a very significant effect ($P<0.01$). The highest crude fat content was obtained in grass with 50 days of cutting age, which was 3.30%, which was not significantly different from the 60-day cutting treatment with 3.17% crude fat content and significantly different from the 70-day cutting treatment with 2.18% crude fat content. Crude grass fat content decreased at a longer cutting age. The results of this study are not in line with [25] which states that the older the plant is, the water content will decrease but the crude fat content will increase. The difference in crude fat content is caused by the level of soil fertility, different rainfall and climate will give a different picture of the results on the crude fat content of a plant which will be inversely proportional to the water content. [26] stated that the increasing age of the plant resulted in a smaller ratio of leaves to stems. The small ratio of leaves to stems affects the content of crude protein, crude fat, energy content, and other nutrient content [27]. This is because the most plant nutrient content is found in the leaves compared to the stems, if the ratio of leaves is greater than that of the stems, the amount of nutrients in the plant will be higher [28].

## 4. Conclusions

Based on the results of the study, it can be concluded as there was a significant ($P<0.05$) to very real ($P<0.01$) Interaction between type of grass and cutting age on nutritional quality (moisture content, ash content, organic matter, crude protein content, and crude fiber content) except crude fat content. The nutritional quality of grass types and the best cutting age [the highest moisture content of bio-grass with a cutting age of 50 days ($R_3U_1$), the highest ash content of zansibar grass at 60 days of cutting age ($R_2U_2$), the highest organic matter grass bio grass cut age 70 days ($R_3U_3$), the highest crude protein content of zansibar grass at 50 days of cutting age ($R_2U_1$), the highest crude fiber content of pakchong grass at 50 days of cutting age ($R_1U_1$), and the highest crude fat content of pakchong grass cutting age 50 days ($R_1U_1$).

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