Productivity and Nutrient Quality of Elephant Grass, Pakchong Grass, Red Navier Grass and Odot Grass as a Source of Animal Feed

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Abstract Feed is the primary need of the livestock business world; in intensive livestock farming, the cost of feed reaches around 70% of the total production cost, so the price of feed ingredients determines the cost of production. The main feed source of ruminants is forage, and, therefore, the productivity of ruminants depends very much on the availability of good fodder ingredients and a guarantee of quality. The goal of this research was to examine the productivity and nutritional quality of elephant grass, pakchong, red napier, and odot as livestock feed that may be grown in Indonesia. The observed data were analyzed descriptively. The results show that pakcang grass has the highest plant height and greater productivity compared to others. Odot grass has better nutritional quality based on crude protein and crude fiber content compared to others. Red napier grass, pakcang grass, elephant grass, and odot grass are forages that have the potential to be used as a source of feed ingredients for livestock in Indonesia.

1 Introduction

Feed is the primary need of the livestock business world where in intensive livestock farming the cost of feed reaches around 70% of the total production cost, so the price of feed ingredients determines the cost of production. The main feed source of ruminants is forage and, therefore, the productivity of ruminants depends very much on the availability of good fodder ingredients and a guarantee of quality. Undernutrition reduces animal growth and milk production and decreases farmers' income as they are less able to feed their animals. They also become weaker or more susceptible to diseases which results in a decrease in fertility. Maximizing the utilization of forage is a more effective use of feed costs to meet the needs of ruminants.

There is more than 90% of energy and protein needs that can be met by grass. Grass is also a very economical animal feed and can provide as much as 11.5 MJ of energy metabolism and 17% protein per kg of dry matter. However, the management and utilization of this forage is not optimal. Accordingly, its productivity and quality have to be determined.

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Elephant grass, also known as Napier grass or Ugandan grass, is a monocot of the Poaceae family and the genus Pennisetum. There is cultivation of about 25 different varieties of Pennisetum grass. To cope with the local conditions, a number of elephant grass varieties have been introduced all over the world and they vary from one country to another in terms of behavior, yield potential as well as nutritional value. Elephant grass is a fodder species with high biomass production, endurance to long-term drought, adaptability to varied soil types, and mechanical cutting [7]. Elephant grass contains somewhere between 4.4 and 20.4% protein, with a mean of about 12%. Most of this grass is cultivated in Indonesia and is mostly utilized in cut-and-carry systems for the feed of dairy and beef cattle. Its popularity amongst farmers can be attributed to the abundance of dry matter potential, ease of propagation, cultivation and harvesting. Napier varieties that are widely developed in Indonesia include elephant grass (Pennisetum purpureum), pakchong grass (Pennisetum purpureum x P. Americanum), odot grass (Pennisetum purpureum cv. Mott), red napier grass (Pennisetum purpureum cross). Although napier grass has been used extensively in animal production, the review of its use as a feed for ruminant animals is limited. The knowledge and guidelines on the efficient use of this grass, whether for one diet or in combination with other feeding stuffs to increase animal productivity are not available to a large majority of farmers. This study aims to determine the productivity and nutritional quality of elephant grass, pakchong, red napier, and odot as forage for livestock that can be developed in Indonesia.

2 Materials and Methods

2.1 Cultivation

The materials used were seeds (cuttings) from elephant grass (Pennisetum purpureum), red napier grass (Pennisetum purpureum cross), pakchong grass (Pennisetum purpureum x P. Americanum) and odot grass (Pennisetum purpureum cv. Mott). The forage plots of each type of forage measure 2 m x 2 m and are separated by a 0.5 m lane between them. Planting material is planted in lines at a distance of 0.5 m x 0.5 m. Basic fertilization is carried out before the planting process using organic fertilizers, urea (46% N), phosphorus (18 P2O5) and KCl (50% K2O). Watering and weeding weed are done every day in the morning.

2.2 Data Collection

2.2.1 Plant Height

Plant height measurements were carried out every week from the first week to the seventh week. Measurements were made by measuring the height of the plant from the ground surface to the highest point of the plant.

2.2.2 Productivity
Productivity data was obtained at the time of harvest at the age of 60 days after planting. The plants are cut at a height of 10 cm, and their fresh weight production is calculated after they have been weighed. To measure dry weight production, as much as 300 grams of each type of forage is taken and cut (3 – 5 cm). Then place in the oven at 60 for 2 days. The resulting weight after drying is the weight of dry matter. Dry weight production was determined by multiplying the percentage of total dry matter production of fresh materials.

2.2.3 Nutrient Quality

The measurement of nutrient quality was done by measuring the content of dry matter, crude protein, and crude fiber. Samples for dry matter, crude protein, and crude fiber analyses were prepared in accordance with the procedure of AOAC (2005).

2.3 Data Analyses

Data was summarized using descriptive analysis. Descriptive analyses include fed production, dry matter production and nutrient quality of forage. Data about plant height were statistically evaluated using analysis of variance (ANOVA) and SPSS 21.

3 Result and Discussion

3.1 Plant Height

Data of plant height forage are presented in Figure 1. The highest plant height is produced by pakcong grass of 147.4 cm at 7 weeks of age. The plant height of pakcong grass in this study is lower than in the study by [1], [5] which can reach 235.56 cm and 244 cm which were harvested at the age of 60 days. In the second order, red navier grass was 136.88 cm, elephant grass was 112.6 cm, and finally odot grass was 63.4 cm. The plant height of the odot grass in this study os lower than in the study by Budiman et al. (2012) which can reach 104.75 cm which was harvested at the age of 8 weeks.

3.2 Fresh Weight and Dry Weight Production

Data of fresh weight production and dry weight production are presented in Table 1. The highest fresh weight production reached 82.03 ton/ha produced by pakcong grass. In line with the fresh weight output, Pakcong grass also had the highest dry weight production, reaching 16.46 tons per hectare. According to [5], [1], compared to other grasses like Co-3 and giant grass, Pakcong grass produces more biomass. In second place, elephant grass produced a fresh weight production of 52.25 tons/ha with a dry weight production of 8.26 tons/ha. Furthermore, fresh weight production of odot and red navier grass was 19.75 tons/ha and 18.00 tons/ha with dry weight production of 3.16 tons/ha and 3.86 tons/ha. The proportion of dry matter present in forages varies with plant age. The older the plant, the less water it contains, and the proportion of cell walls is greater than the number of cells. If the plant’s cell wall content is higher, the plant will have more dry matter. The dry matter production of forage generally correlates with plant height [1]. The potential for dry matter production increases with plant height because it supports the components contained in the plant to be converted to nutrients [6]. This statement is consistent with the results obtained in this study, which showed that pakcong grass harvested at the age of 60 days had the highest...
plant height and the highest dry weight production. In contrast, the dry weight of the plant is determined by the rate of dry matter preparation and growth. This is believed to be caused by the accumulation of dry matter biomass, which is highly influenced by the age of the plant. A longer harvesting duration will result in more dry matter biomass accumulation than a shorter lifespan [8].

3.3 Nutrient Quality

The nutritional quality of forage is determined by its crude protein and crude fiber levels. Figures 2 and 3 show data for the crude protein and crude fiber content of forages.

The crude protein content in red napier grass, pakchong, and elephant grass has almost the same value, namely 8.65%, 8.65%, and 8.76%, respectively. Meanwhile, odot grass has the highest protein content among the four types of forage, namely 11.15%.

![Crude Protein Content of Forage](image1)

**Fig. 2.** Crude Protein Content of Forage

![Crude Fiber Content of Forage](image2)

**Fig. 3.** Crude Fiber Content of Forage

The crude fiber content of odot grass is the lowest compared to red napier grass, pakcong grass, and elephant grass. [2] compared the quality of *Pennisetum purpureum* forage based on the type of growth, namely the tall-type and short-type. Based on the results of his research, it was shown that the short-type *Pennisetum purpureum* had better nutritional quality than the tall-type, with higher dry matter and crude protein content and lower crude fiber content. Red napier grass, pakchong grass, and elephant grass belong to the tall-type *Pennisetum purpureum*, while odot grass belongs to the short-type *Pennisetum*.
purpureum. So that the nutritional quality of odot grass is superior compared to the others. Physiologically, the tall type of elephant grass requires structural carbohydrates to form a higher cell wall than the short type of elephant grass to erect a sturdier stem. Cell walls in the form of cellulose and hemicellulose play an important role so that the stem structure is more massive, and the plant can support the load of the leaves, which are increasing in dry matter.

Another factor that affects the fiber content of the two types of elephant grass is the age of harvest. The short type of elephant grass plants reaches physiological maturity relatively quickly, so they are harvested faster, namely at an average age of 30–40 days compared to the tall type of elephant grass plants, which are harvested on average at around 40–60 days. The value of the fiber fraction increases with increasing harvesting age [3]. Thickening of the cell wall occurs more intensively during the vegetative phase until the plant reaches physiological maturity, as do water-soluble carbohydrates (WSC), which increase to a peak at 6–7 weeks [4].

![Plant Height (cm)](image)

**Fig. 1.** Plant Height of Forage

<table>
<thead>
<tr>
<th>Forage</th>
<th>Fresh weight production (ton/ha)</th>
<th>Dry weight production (ton/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red Navier Grass</td>
<td>18.00</td>
<td>3.86</td>
</tr>
<tr>
<td>Pakcong Grass</td>
<td>82.03</td>
<td>16.46</td>
</tr>
<tr>
<td>Elephant Grass</td>
<td>52.25</td>
<td>8.26</td>
</tr>
<tr>
<td>Odot Grass</td>
<td>19.75</td>
<td>3.16</td>
</tr>
</tbody>
</table>

**Table 1.** Production of Forage
4 Conclusion

Red napier grass, pakcong grass, elephant grass, and odot grass are forages that have the potential to be used as a source of feed ingredients for livestock. Based on its productivity, Pakcong grass has the highest production. Based on its nutritional quality, odot grass has the best nutritional quality among the others.

Acknowledgements

The author's thanks go to the College of Vocational Study at IPB University for funding this research through the Hibah Penelitian Sekolah Vokasi IPB.

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