Effect of Cutting Frequency of Cassava Leaves on Composition and Production during the Dry Season

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Effect of Cutting Frequency of Cassava Leaves on Composition and Production during the Dry Season

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Abstract. Cassava leaves are an alternative feed derived from agricultural crops by-product. This study aimed to determine the effect of cutting frequency on the production and chemical composition of cassava leaves. This study was conducted in the Kwarasan Wetan, Kedungkeris, Nglipar, Gunungkidul during the dry season. Farmland with a size of 18 x 12 m has been planted with cassava plantation 5 months old and was divided into 4 blocks as replication, the size of each block was 18 x 3 m. Each block consisted of 3 treatments with the plot size of each treatment was 6 x 3 m which were cut 1, 2 and 4 times. Each treatment consisted of 12 plants, and each plant was conditioned to have 2 stems and cut with different intensities. Leaves and edibles stem were analyzed. The variables observed were content of dry matter (DM), organic matter (OM), crude fiber (CF), crude protein (CP), extract ether (EE), nitrogen-free extract (NFE), total digestible nutrients (TDN), and dry matter, organic matter, crude protein, and total digestible nutrients production. The data obtained were analyzed according to the completely randomized design (CRD), the differences between treatments were further tested by Duncan's new multiple range test (DMRT). The results showed that the cutting frequency had a significant effect ($P<0.05$) on dry matter and total digestible nutrients. The highest dry matter content was shown at 2 times cutting frequency (32.21%) and the lowest crude fiber at cutting 4 times frequency (17.97%). The 2 and 4 times cutting frequencies were able to increase the production of cassava leaves ($P<0.05$). Based on the results it can be concluded that the most appropriate cutting frequency is 2 times.

1. Introduction

The availability of feed that is able to meet the needs both qualitatively and quantitatively is one of the main factors that need to be considered in the selection of animal feed. In general, the availability of forage in Indonesia is influenced by the season. Feeds are available in large quantity during the rainy season however lack during the dry season.

One alternative in fulfilling feed during the dry season is to use agricultural crops by-products. Cassava is an agriculture plant that is often used as animal feed, especially its leaves. Cassava (*Manihot utilissima*) is an annual plant; this plant is a food commodity that can grow in both tropical and subtropical regions. Cassava can be planted in sandy clay types with low organic matter content, low rainfall, and high temperature. These plants in some countries are generally grown by small farmers along with other farming systems as additional sources of income [1]. Based on data, cassava production in Indonesia has decreased in the last five years from 24,044,025 tons in 2011 to only 21,801,415 tons in 2015 or decreased by 9.33% [2].

One of the problems in utilizing cassava leaves as a source of animal feed is the high crude fiber content. The high content of crude fiber is caused by the age of cutting the leaves which are carried out

together with the process of harvesting cassava. The cutting age is classified as quite old because cutting is done once a year. The older of cutting age can increase the production but the inversely proportional to the quality of feed (crude fiber content increased, crude protein decreased) [3].

One alternative that can be done to reduce the crude fiber content is by plant cutting periodically. It is expected to provide optimal results and be able to maintain leaf quality. Another goal of periodic cutting is that the availability of cassava leaves is maintained even in the dry season. The quality of animal feed can be seen based on its chemical composition. The older the plant has decreased in the quality of its chemical composition. Structural carbohydrate fractions in older plants tend to be higher compared to young plants. Based on this problem, an alternative means is needed to maintain maintenance and forage quality.

2. Material and Methods

2.1. Location

This study was conducted in Kwarasan Wetan, Kedungkeris, Nglipar, Gunungkidul, Yogyakarta during dry season. The altitude of field location is at 200 meters above sea level with an average temperature of 20 to 30° C and an average rainfall of 2,000 mm per year.

2.2. Material

The material used in this study was cassava plants of 5 months old variety of Gatotkaca. Cassava planted among eucalyptus plants in the type of alfisol soil that had been fertilized with TSP and urea as much as 5 kg and 12.5 kg per plot size of 18 x12 m. Cassava was planted on flat soil with planting space of 75 cm intercropped with peanut plants. The material used in the chemical analysis consisted of 1.25% H_2SO_4, 1.25% NaOH, ethyl alcohol, concentrated H_2SO_4, H_3BO_3 0.1 N, Kjeldahl tablets (Merck's® catalyst for nitrogen detection), mix indicator, 50% NaOH and HCl 0.1 N.

The equipment used in this study include: Shanghai Yamato scales with sensitivity of 1 g, ATS scales with sensitivity of 100 g, oven with a temperature of 55 °C, Willey Mill with a screen diameter was 2 mm, silica disc, crucible, beaker glass, Soxhlet, and Erlenmeyer.

2.3. Methods

This study was conducted following a completely randomized design (CRD). Farmland with a size of 18 x 12 m was divided into 4 blocks measuring of 18 x 3 m as replication. Each block was divided into 3 plots with a range of 6 x 3 m which was determined randomly. Each plot consists of 12 plants, and each was conditioned to have 2 plant stems. As a treatment namely control (leaves cut at 9 months 15 days), cut 2 times (cut at 5 months and 9 months 15 days) and cut 4 times (cut at 5 months, 6.5 months, 8 months, and 9.5 months). Defoliation at each treatment was carried out with a distance of 20-30 cm above the soil surface and for further cutting the part was cut on the stem regrowth. The sample of cassava leaf was then weighed and dried at 55° C, after which the dried sample then ground using a Willey mill. The samples were then analyzed for chemical composition [4]. Total digestible nutrients (TDN) were calculated using a regression [5]. Significant differences between treatments were further tested by Duncan's new multiple range test (DMRT) [6].

3. Result and Discussion

3.1. Chemical Composition

The results showed there was a significant difference ($P<0.05$) in the dry matter content of cassava leaves with different cutting frequencies. The dry matter content in the control, 2, and 4 times harvesting were 28.18, 32.21 and 21.15% respectively. The highest dry matter content was obtained at cutting twice. Older plants were thickening of cell walls, which resulted in increased dry matter. The older plant contained higher cell wall content [7].

Organic matter content in cassava leaves with different cutting frequencies did not show any significant differences ($P>0.05$). The organic matter content in control, 2, and 4 times cutting were

91.22, 91.63, and 91.77%. The content of organic matter was not significantly different; it was probably due to the same soil conditions and varieties. The organic matter content of cassava leaves at harvesting is 91.58% [8].

Analysis of variance did not show any significant differences (P>0.05) on crude fiber of cassava leaves with different cutting frequencies. Crude fiber content in the control, 2, and 4 cutting times were 19.17, 19.74, and 17.94%. The crude fiber content in the plants increases with the length of life of the cutter. Therefore, the older plant had higher fiber content. In connection with the development of maturity (age of plants) forage, there will also be an increase in fiber concentration [7].

There was no significantly different (P>0.05) on crude protein content of cassava leaves cut in several cutting frequencies. Crude protein content in the control, 2, and 4 cutting times were 22.05, 22.39, and 23.56% respectively. Extended cutting interval will decrease crude protein content. Decreasing of crude protein content with addition of plant age was also caused by a decreasing in the proportion of leaves with petioles and stems, where the leaves have a higher protein content compared to the petioles and stems [9].

The extract ether content of cassava leaves at different cutting frequencies did not also show any significant differences (P>0.05). The extract ether content of cassava leaves in control, cutting twice, and cutting 4 times were respectively 7.62, 6.73, and 5.25%.

Table 1. Chemical composition of cassava leaves with different cutting frequencies

Parameter	Control	Cutting 2 times	Cutting 4 times
Dry matter (%)	28.18 ± 0.96^{b}	32.21 ± 4.45^{c}	21.15 ± 1.17^{a}
Organic matter (%)	91.22 ± 0.41	91.63 ± 0.44	91.77 ± 0.42
Extract ether (%)	7.62 ± 2.60	6.73 ± 1.28	5.25 ± 1.80
Crude fiber (%)	19.17 ± 0.70	19.74 ± 0.62	17.97 ± 0.46
Crude protein (%)	22.05 ± 1.58	22.39 ± 2.01	23.56 ± 2.13
Nitrogen free extract (%)	42.40 ± 3.07	42.77 ± 3.39	45.00 ± 2.33
Total digestible nutrients (%)	68.22 ± 1.08^{a}	68.45 ± 0.30^{a}	70.45 ± 0.87^{b}

[a,b,c] Different superscript in same-row shows significant difference (P<0,05)

The results of the analysis of variance showed that the nitrogen-free extract (NFE) on cassava leaves with different cutting frequencies did not show any significant differences (P>0.05). NFE in the control, 2 and 4 cutting times were 42.40, 42.77 and 45.00%. NFE content is strongly influenced by other fractions contained in plants. Increasing other fraction lowered the NFE content of the plant.

Total digestible nutrients (TDN) in cassava leaves with different cutting frequencies showed significant differences (P<0.05). The TDN in the control, 2, and 4 cutting times were 79.23, 76.81, and 74.42%. The highest TDN was shown at 4 times cutting intervals. TDN was strongly influenced by the chemical composition of plants. The higher fraction that was easily degraded such as protein and NFE can increase the TDN.

3.2. Production

Dry matter production of cassava leaves with different cutting frequencies showed significant differences (P <0.05). Dry matter production on control, 2, and 4 cutting times were 102.98, 1,333.03, and 1,332.53 kg/ha respectively. Control treatment resulted in lower dry matter production compared to cutting 2 and 4 times. The presence of cutting causes regrowth and produce more dry material production compared with only one cut. Increasing of fresh produce will increase the production of dry matter because the production of dry matter is the result of fresh produce with dry matter content [10].

The results of the analysis of variance showed a significant difference (P <0.05) on the organic matter production of cassava leaves with different cutting frequencies. Organic matter production of cassava leaves which was cut 1, 2, and 4 times were 93.99, 1,220.37, and 1,223.04 kg/ha. Organic matter production at cutting 2 and 4 times were higher than the control treatment. The high of organic matter production was in direct proportion to the high of dry matter production. The production of

organic matter will depend largely on fresh and dry matter production, as well as the content of plant organic matter [11].

Table 2. Dry matter, organic matter, crude protein, and total digestible nutrients production of cassava leaves with different cutting frequency (kg/ha)

Treatment	DM Production	OM Production	CP Production	TDN Production
Control	102.98 ± 43.80[a]	93.99 ± 40.49[a]	22.89 ± 10,04[a]	63.95 ± 27.21[a]
Cutting 2 times	1,333.03 ± 394.64[b]	1,220.37 ± 357.39[b]	292.51± 60,04[b]	834.98 ± 242.72[b]
Cutting 4 times	1,332.53 ± 179.43[b]	1,223.04 ± 16.74[b]	314.85 ± 58,22[b]	862.53 ± 125.21[b]

[a,b,c] Different superscript in same column shows significant effect (P<0,05)

Crude protein production of cassava leaves with different cutting frequencies showed significant differences (P<0.05). The results of crude protein production in the treatment of cutting 1, 2, and 4 times were 22.89, 292.51, and 314.85 kg/ha. The cutting of 2 and 4 times resulted in an increase crude protein production of cassava leaves, but there was no significant difference between cutting 2 and 4 times. The presence of cuts affected the chemical composition and plant growth. Cutting tended to slow the maturity of the plant by forming new branches so that the protein produced was higher than the old one. Crude protein production on forage depended on dry matter production of and crude protein content of forage [12].

The results of the analysis of variance in the total digestible nutrients production (TDN) in cassava leaves with different cutting frequency showed significant difference (P<0.05). TDN Production of cassava leaves at 1, 2 and 4 times cuts was 63.95, 834.98 and 862.53 kg/ha. These results indicated that there was a cut of 2 and 4 times to increase TDN production in cassava leaves. Cutting caused the growth of young leaves that had higher non-structural components compared to old leaves. Non-structural components in young leaves increased TDN production in cassava leaves. Increasing in cutting age will increase the proportion of twigs and reduce the proportion of leaves. Increasing the proportion of twigs will increase the structural content, thereby reducing TDN [3].

Based on production of dry matter, organic matter, crude protein and TDN there was no difference between the cutting frequency 2 and 4 times, but the cutting frequency 4 required more time, so the cutting frequency 2 times was better.

4. Conclusion

Cassava leaves can be cut after 5 months. Cutting of cassava leaves can be done 2 until 4 times to get the highest production on crude protein and TDN. It is recommended that cassava leaves better to be cut twice on 5 and 9.5 month.

5. References

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