Effect of Different Pruning Intervals on Nutrient Composition of Vines from Seven Sweet Potato Cultivars

N Thiasari, E Indawan, S U Lestari and P Sasongko
Faculty of Agriculture, University of Tribhuwana Tunggadewi, Malang 65144, Indonesia
nurita.thia@gmail.com

Abstract. The experiment was conducted to evaluate the effect of different pruning intervals on nutrient composition and yield of vines from seven sweet potato cultivars. Treatments were arranged in a split-plot design with three replications. The pruning intervals were 80, 90, 120, and 150 days after planting as the main-plots and the trimming volume of sweet potato vine was 25%. Seven sweet potato cultivars (Kuningan Putih, Beta 2, Kuningan Merah, BIS OP-61, 73 OP-5, BIS OP-61-♀-29 and BIS OP-61-OP-22) were in the sub-plots and allocated at random. Results showed that increasing the pruning intervals increased dry matter, organic matter, and crude fiber significantly. However, ash and crude protein were decreased as the trimming intervals increased. Eter Extract was unaffected by trimming intervals.

1. Introduction

In developing countries, crop residues are commonly used as ruminant feed to fulfill their energy needs. Crop residues are valuable ruminants feed source due to its availability in large numbers and generally have some potential nutritive value. One of the fibrous crop residues that can be easily obtained is sweet potato vines, which is obtained after harvesting tubers. Sweet potato (Ipomoea batatas L.), a major tropical crop, is widely cultured in many parts of the world. Generally, Sweet potato tuber can be harvested in early-maturing stages from 90 days after planting to 180 days after planting or more [1]. There is a large number of sweet potato vines produced during tuber harvesting, and then it can be fed to ruminants [2].

Nutritive value of forage is generally determined by the availability of nutrients in the plant for the ruminant, which is influenced by the chemical composition of the forage. It is related to the limitation of utilization cellulose and hemicellulose, the total amount of lignin, silica, and plant cell wall substances. The chemical composition of the forage depends on light exposure, temperature, stage of maturity, and plant types [3]. Sweet potato, as one of the crop residues, has a potential nutritive value based on the dry matter intake [4]. The stage of maturity and different cultivar of sweet potato vines might have varied on the nutritive value. This study was conducted to investigate the effect of pruning intervals on yield and chemical composition of vines from seven sweet potato cultivars.
2. Materials and methods

2.1. Site description

The experiment was conducted from March to July 2017 at the Brawijaya University Experimental Station in Jatikerto Village, Kromengan District, Malang Regency, East Java Province. The soil at this site is classified as Alfisol (352 m above sea level). The texture and chemical characteristics of the soil are shown in Table 1.

| Parameters       | Value |
|------------------|-------|
| Sand (%)         | 17    |
| Silt (%)         | 35    |
| Clay (%)         | 48    |
| pH (H₂O)         | 5.5   |
| C-organic (%)    | 0.87  |
| N-total (%)      | 0.09  |
| C/N              | 10    |
| P-Bray1 (mg/kg)  | 0.76  |
| K (me/100 g)     | 2.61  |
| Na (me/100 g)    | 1.27  |
| Ca (me/100 g)    | 6.57  |
| Mg (me/100 g)    | 2.19  |
| CEC (Cation Exchangeable Capacity (me/100 g)) | 18.96 |
| Base Saturation (%) | 67   |

2.2. Experimental treatments and design

The experiment was arranged in a split-plot design with three replication. Pruning intervals were 80, 90, 120, and 150 days after planting as the main-plots and the trimming volume was 25% from the total number of above-ground branches of sweet potato vines. Seven sweet potato cultivars (Kuningan Putih, Beta 2, Kuningan Merah, BIS OP-61, 73 OP-5, BIS OP-61-♀-29 and BIS OP-61-OP-22) were in the subplots allocated randomly. Each experimental plot was 5 m x 2.5 m, and sweet potato cuttings height were 25 cm, then those were planted at the single row with the spacing of 25 cm. Basic fertilizer (NPK) was applied with the dosage 400 kg/ha (15 15 15) biochar at a dose of 5 t/ha.

Nutrient composition (dry matter, ash, organic matter, crude protein, crude fiber, and ether extract) and yield of sweet potato vine from each cultivar were measured after being harvested (150 days after planting). Chemical analysis to determine nutrient composition (dry matter, ash, organic matter, crude protein, and crude fiber) of sweet potato vines were carried out at the Animal Nutrition Laboratory, Faculty of Animal Science, Brawijaya University.

2.3. Statistical analysis

Data for all determinations were subjected to analysis of variance (ANOVA). Least significant difference (LSD) test was used to identify significant differences among treatment means.

3. Result and discussion

There was variation among nutrient compositions of seven sweet potato vines trimmed at pruning interval (Table 2). Pruning interval had a significant effect on the percentage content of all the components measured except ether extract, with dry matter percent, organic matter, and crude fiber increasing as the pruning interval increased. Atis et al. [5], Peiretti [6], and Xie et al. [7] found that the dry matter, organic matter, and crude fiber increased with increasing maturity stage. A negative correlation was found between organic matter and ash of the sweet potato vines. Ash and crude protein showed a decrease as the pruning interval increased. Xie et al. [7] found that the average of ash and
The 4th Animal Production International Seminar
IOP Conf. Series: Earth and Environmental Science 478 (2020) 012062
doi:10.1088/1755-1315/478/1/012062

... crude protein were decreased with the increasing maturity stage of the plant. Crude protein of the plant gradually reduced with the delay of harvest time because the more mature phase of the plant will reduce protein synthesis due to weak photosynthesis [8].

Table 2. Means of the nutrient composition of seven sweet potato vines with different pruning intervals

| Pruning interval (Days After Planting) | Cultivar          | Dry Matter (DM) % | Organic Matter (OM) % | Ash (%) | Crude Protein % | Crude Fiber % | Ether Extract (%) |
|----------------------------------------|-------------------|-------------------|-----------------------|--------|-----------------|---------------|------------------|
|                                        | Kuningan Putih    | 12.48             | 83.09                 | 16.91  | 17.19           | 27.34         | 4.47             |
|                                        | Beta 2            | 13.07             | 79.79                 | 20.21  | 22.60           | 23.92         | 3.83             |
|                                        | Kuningan Merah    | 10.27             | 82.77                 | 17.23  | 22.88           | 19.78         | 4.27             |
|                                        | BIS OP-61         | 11.23             | 85.36                 | 14.64  | 19.36           | 21.72         | 4.29             |
|                                        | 73-OP-5           | 10.81             | 82.86                 | 17.14  | 17.53           | 21.18         | 4.00             |
|                                        | BIS OP-61-♀-29    | 10.39             | 82.84                 | 17.16  | 18.08           | 27.72         | 4.25             |
|                                        | BIS OP-61-OP-22   | 12.41             | 83.54                 | 16.46  | 19.99           | 19.24         | 4.11             |
|                                        | Kuningan Putih    | 13.08             | 87.35                 | 12.65  | 18.45           | 24.14         | 3.99             |
|                                        | Beta 2            | 13.16             | 86.21                 | 13.79  | 17.32           | 25.47         | 4.59             |
|                                        | Kuningan Merah    | 10.81             | 85.43                 | 14.57  | 19.64           | 19.28         | 4.04             |
|                                        | BIS OP-61         | 11.60             | 87.94                 | 12.06  | 19.29           | 19.33         | 3.89             |
|                                        | 73-OP-5           | 12.60             | 86.83                 | 13.17  | 15.23           | 20.36         | 5.02             |
|                                        | BIS OP-61-♀-29    | 10.67             | 86.19                 | 13.81  | 20.37           | 20.53         | 3.94             |
|                                        | BIS OP-61-OP-22   | 12.12             | 87.54                 | 12.46  | 16.71           | 20.12         | 3.75             |
|                                        | Kuningan Putih    | 13.88             | 84.66                 | 15.34  | 17.86           | 19.33         | 3.80             |
|                                        | Beta 2            | 14.38             | 85.50                 | 14.50  | 16.18           | 18.15         | 4.11             |
|                                        | Kuningan Merah    | 13.16             | 85.85                 | 14.15  | 19.45           | 17.13         | 3.71             |
|                                        | BIS OP-61         | 12.27             | 88.24                 | 11.76  | 17.41           | 21.23         | 3.57             |
|                                        | 73-OP-5           | 13.74             | 86.83                 | 13.17  | 18.86           | 14.86         | 4.04             |
|                                        | BIS OP-61-♀-29    | 12.70             | 87.02                 | 12.98  | 14.09           | 18.81         | 3.48             |
|                                        | BIS OP-61-OP-22   | 16.20             | 88.12                 | 11.88  | 14.69           | 14.53         | 4.26             |
|                                        | Kuningan Putih    | 14.26             | 86.32                 | 13.68  | 12.35           | 21.09         | 3.87             |
|                                        | Beta 2            | 16.23             | 83.15                 | 16.85  | 14.92           | 17.19         | 4.06             |
|                                        | Kuningan Merah    | 12.48             | 83.96                 | 16.04  | 15.19           | 27.84         | 3.71             |
|                                        | BIS OP-61         | 12.74             | 86.25                 | 13.75  | 11.33           | 24.90         | 2.92             |
|                                        | 73-OP-5           | 14.18             | 84.96                 | 15.04  | 11.19           | 25.96         | 4.07             |
|                                        | BIS OP-61-♀-29    | 13.39             | 82.47                 | 17.53  | 13.38           | 23.10         | 3.19             |
|                                        | BIS OP-61-OP-22   | 16.27             | 86.15                 | 13.85  | 13.24           | 23.81         | 3.50             |

4. Conclusions
The pruning intervals affected for nutrient composition of sweet potato vines (dry matter, organic matter, ash, crude protein, and crude fiber). However, there was no significant difference in ether extract, fresh yields, and dry matter yield of sweet potato vines with different pruning intervals in this study.

Acknowledgments
This study was conducted with financial support from the DPRM-Kemenristek Dikti, Indonesia, from the research program PUPT year of 2018. We thanked Balitkabi for providing several cultivars of sweet...
potato, and Brawijaya University, especially the Faculty of Agriculture (Site of the experiment), also Faculty of Animal Science (Nutrient composition analysis site).

References

[1] Adu-Kwarteng, Evelyn, Esther O, Sakyi-Dawson, George S A, Van-Den T, Fred F S S and Kim D 2014 Variability of sugars in staple-type sweet potato (Ipomoea Batatas) Cultivars: The Effects of Harvest Time And Storage. International Journal of Food Properties 17 410-420

[2] Scoot G J 1992 Sweet Potatoes as Animal Feed in Developing Countries: Present Patterns and Future Prospects. In Roots, tubers, plantains, and bananas in animal feeding, ed. D Machin and S. Nyvold. Proceedings of the FAO expert consultation held at CIAT, Cali, Colombia.

[3] Van-Soest P 1969 Composition, maturity, and the nutritive value for forages Advances in Chemistry 95(16) 262-278

[4] Baba M, Aminu N, Inusa S K, Ibrahim R M and Nuhu B R 2018 Nutritional Evaluation of Sweet Potato Vines from Twelve Cultivars as Feed for Ruminant Animals Asian Journal of Animal and Veterinary Advances 13(1) 25-29

[5] Atis I, Omer K, Mehmet E D, Huseyin G, Selcen Y 2012 Effect of harvesting time on yield, composition and forage quality of some forage sorghum cultivars International Journal of Agriculture and Biology 14(6) 1560-8530

[6] Peiretti P G 2009 Effects of growth stage on chemical composition, organic matter digestibility, gross energy, and fatty acid content of safflower (Carthamus tinctorius L.) Livestock Research for Rural Development 21(12) 206

[7] Xie Z L, Zhang T F, Chen X Z, Li G D and Zhang J G 2012 Effects of maturity stages on the nutritive composition and silage quality of whole crop wheat Asian-Australas J. Anim. Sci., 25(10) 1374–1380

[8] Throop H L 2005 Nitrogen deposition and herbivory affect biomass production and allocation in an annual plant OIKOS 111 91-100