Analysis of botanical composition and nutrient content on natural pastures in Samosir Island of Samosir Regency

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Abstract. Samosir regency is one of the areas that have large grazing area. The potential of grazing production in the area plays an important role for the development of livestock, especially on ruminant livestock. The study aims to know the botanical composition and the nutritional content of forage on natural pasture at the Samosir Island. Animal feed assessment method on natural pastures in Samosir regency includes the determination of research location points based on the altitude through the survey method. Location of the study amounted to 15 locations. The result showed that at altitude 905 – 1200 meters above sea level had a botanical composition were 31 species with ratio of grass 80.58 %, legumes 9.14 % and weeds 9.34 % and the most dominant forage is Imperata cylindrica l. The botanical composition at altitude more than 1205 meters above sea level is 15 species with ratio of grass 92.72 %, legumes 2.87 % and weeds 4.39 % and the most dominant forage is Axonopus compressus. The forage which has the highest crude protein is Starkuak 15.13 %. The conclusion that the altitude in pastures give effect on the botanical composition of forages.

1. Introduction
Community livestock business in Samosir Regency is still very simple. Livestock breeding uses extensive systems (not stacked). Livestock only grazed above the hills of Lake Toba as well as on the slopes, hills especially on empty fields. If viewed the actual condition, the area of Samosir Regency is 1444.25 km² with an empty land area of 46036.39 ha and 21046 ha of shrubs (where the bushes and shrubs grow).

Based on altitude, Samosir Island is located at altitude 904–2157 meters above sea level. Condition of Samosir Island has hilly and bumpy contours with natural expanse of grassland that is wide enough spread in various places. The natural grasslands have the potential and deserve to be developed further as a provider of forage feed. Therefore, based on the altitudes of different places it is necessary to analyze the botanical composition and nutritional content of grasslands on Samosir Island.

This study aims to determine the botanical composition and nutrient content of forage on natural pastures contained in Samosir Island.
2. Materials and Methods
The research has been carried out in Samosir Island, Samosir District start from July to October 2016.

The materials used are forage samples that taken from Samosir Island. The tools used includes: 1x1 m square quadrant as a tool for measuring forage production, scissors for cutting forage, scales as a means of weighing fresh materials and dry materials, oven as a means of drying fresh material to obtain dry matter.

2.1. Determination of Sampling Site
The selection of research location was carried out purposive in Samosir Island are:

a. At altitude 905–1200 meters above sea level consist of several villages. They are among others Simbolon, Unjur, Garoga, Marlumba, Suhi-Suhi Dolok, Parbaba Dolok, Lumban Pinggol, Onanrunggu, and Peanabolak.

b. At altitude more than 1205 meters above sea level or a maximum 1690 meters above sea level consist of several villages. They are among others Tanjungan, Sidihoni, Lintong Sunut, Lumban Simbolon and Sipira.

2.2. The Variables Observed
The variables observed in this research are botanical composition and nutrient content analysis. The botanical composition is calculated on the basis of dry matter by the Dry Weight Rank (DWR) method.

Nutrition Content Analysis using proximate analysis includes dry matter, ash content, crude protein, crude fiber, ether extract and beta-N.

3. Result and Discussion
3.1. Overview of Research Sites

Figure 1. Altitude Map

Figure 2. Samosir Island Map

Geographically Samosir Regency is located between 2°21’38" - 2°49’48" LU and 98°24’00" - 99°01’48" BT with altitude between 904–2157 meters above sea level. The total area is about 2069.05 km² and consists of land area of ±1444.25 km² or about 69.80%, that is all Samosir Island surrounded by Lake Toba and some areas of mainland of Sumatera Island and wide of Lake Toba ±624.80 km² (30.20 %) [1].

Topography and soil contours are diverse among others flat, hilly, bumpy, tilted and steep. The soil structure is unstable and is in the path of tectonic and volcanic earthquakes. Topography and soil contours in Samosir District with slope composition: a) 0–20 (flat) ± 10%, b) 2–150 (ramps) ±20%, c) 15–400 (inclined) ±55%, d) >400 (steep) ±15% [1].

3.2. Determination of Research Site
Based on survey results on Table 1 it is known there are 63 points of natural pastures on the island of Samosir where the point is determined based on the interpretation of land area and a reasonable estimate to serve as a place of research. The survey results on the 63 points obtained are then mapped
based on the height of the site, the class of land capability and land use to determine the points of the location where the sample will be taken.

Table 1. Natural Pasture Mapping Based on Altitude on Samosir Island

| Altitude       | Land Of Capability Class | Shrub Land | Open Land | Dry Land Farming | Rice Fields | Swamp |
|----------------|--------------------------|------------|-----------|------------------|-------------|-------|
| 905–1200 meters above sea level | II                       | -          | -         | 4                | -           | -     |
|                | III                      | -          | -         |                  | -           | -     |
|                | IV                       | -          | 22        | 23               | -           | -     |
| More than 1205 meters above sea level | II                       | -          | -         |                  | -           | -     |
|                | III                      | -          | -         |                  | -           | -     |
|                | IV                       | 1          | 1         | 9                | 2           | 1     |

Sampling is then selected based on the analysis that has been done and taken a sample of 15 points that serve as a place for sampling research. Sampling at altitude 905–1200 meters above sea level amounted are 9 locations, while at an altitude above 1205 meters above sea level are 6 locations.

3.3. Botanical Composition

At altitude 905–1200 meters above sea level the forage botanical composition highest is *Imperata cylindrica* l with fresh material production 21.34% and dry matter production 24.34%. Then followed by *Axonopus compressus* has fresh material production 17.40% and dry matter production 17.64%. Furthermore *Paspalum conjugatum* has fresh produce of 13.35% and dry matter production 13.77%.

The botanical composition of each type of forage varies according to the total production of fresh ingredients in each species. In addition, the highest difference is the cultivated *Imperata cylindrica* l because the grass can multiply rapidly due to the rapid development and spread and is easy to grow and resistant to stamping. This is consistent with the statement of Jayadi [2] which states that *Imperata cylindrica* can breed rapidly with its seeds spread rapidly with the wind, or through its rapid rhizomes through the loose soil. *Imperata cylindrica* usually grows on formerly damaged and open forest land, former fields, dry fields, roadsides and so on. To some extent, vegetation fires can stimulate the growth of *Imperata*.

The percentage of botanical composition based on forage weight on natural pastures on Samosir Island at altitude of 905–1200 meters above sea level is shown in Table 2 below.

Table 2. Botanical Composition and Number of Occurrence Frequencies on Natural Pasture in Samosir Regency at Altitude 905–1200 Meters above Sea Level

| No  | Type of Forage           | Botanical Composition (%) | Frequency |
|-----|--------------------------|---------------------------|-----------|
| 1.  | *Imperata cylindrica* l  | 21.34                     | 24.34     | 19        |
| 2.  | *Axonopus compressus*    | 17.40                     | 17.64     | 28        |
| 3.  | *Paspalum conjugatum*    | 13.35                     | 13.77     | 12        |
| 4.  | *Zoysia matrella*        | 10.37                     | 12.75     | 13        |
| 5.  | *Melastoma malabathricum*| 6.02                      | 5.90      | 18        |
| 6.  | *Cynodon plectostachyurus*| 5.10                    | 4.08      | 7         |
| 7.  | *Stylosanthes capitata*  | 4.34                      | 3.71      | 16        |
| 8.  | *Mimosa pudica* l        | 2.92                      | 2.87      | 14        |
| 9.  | *Leptochloa chinensis* l | 2.91                      | 1.91      | 2         |
| 10. | *Digitaria milanjiana*   | 2.83                      | 3.23      | 4         |
At altitude more than 1205 meters above sea level the botanical composition highest is *Axonopus compressus* with fresh material production 66.36% and dry matter production 70.52%. Forage type with the second highest percentage is *Paspalum conjugatum* with fresh material production of 16.54% and dry matter production 15.81%. Then the third highest forage was *Centella asiatica* with fresh material production 4.04% and dry matter production 2.48%.

The percentage of botanical composition based on forage weight on natural pastures on Samosir Island at altitude more than 1205 meters above sea level is shown in Table 3 below.

**Table 3.** Botanical Composition and Number of Occurrence Frequencies on Natural Pastures in Samosir Island at Altitude More Than 1205 Meters Above Sea Level

| No | Type of Forage           | Botanical Composition (%) | Frequency |
|----|--------------------------|---------------------------|-----------|
|    |                          | Fresh Material            | Dry Matter |           |
| 1  | *Axonopus compressus*    | 66.36                     | 70.52      | 13        |
| 2  | *Paspalum conjugatum*     | 16.54                     | 15.81      | 7         |
| 3  | *Centella asiatica*      | 4.04                      | 2.48       | 2         |
| 4  | *Flemingia macrofilia*   | 3.10                      | 2.27       | 1         |
| 5  | *Imperata cylindrica l*   | 2.55                      | 2.67       | 1         |
| 6  | *Eupathorium adenophorum*| 2.06                      | 0.98       | 1         |
| 7  | *Zoysia matrella*         | 1.78                      | 2.01       | 1         |
| 8  | *Stylosanthes capitata*  | 0.96                      | 0.78       | 2         |
| 9  | *Amaranthus sp*           | 0.89                      | 0.69       | 1         |
| 10 | *Cynodon dactilon*       | 0.52                      | 0.47       | 2         |
| 11 | *Mimosa pudica l*        | 0.49                      | 0.43       | 1         |
| 12 | *Chloris gayana*         | 0.28                      | 0.29       | 1         |
| 13 | *Lycopediella cernua*    | 0.20                      | 0.24       | 1         |
| 14 | *Paspalum notatum*       | 0.13                      | 0.18       | 1         |
| 15 | *Leucena sp*             | 0.13                      | 0.17       | 2         |
Comparison of botanical composition on Samosir Island at altitude of 905–1200 meters above sea level and more than 1205 meters above sea level can be seen through the classification of forage feeding on 3 cultivation that are grass, legumes and weeds. This is shown in Table 4 below.

Table 4. Comparison of Forage Species Number on Natural Pasture in Samosir Island At Altitude 905–1200 Meters Above Sea Level and More Than 1205 Meters Above Sea Level

| Type of Forage (%) | Altitude 905–1200 meters above sea level | Altitude >1205 meters above sea level |
|-------------------|----------------------------------------|-------------------------------------|
| Grass             | 80.58                                   | 92.72                               |
| Legumes           | 9.14                                    | 2.87                                |
| Weeds             | 9.63                                    | 4.39                                |

Grass are more dominate grazing in Samosir Island than legumes. The most dominant forage botanical species at both altitude sites are *Axonopus compressus*, *Imperata cylindrica l* and *Paspalum conjugatum*. The result of botanical composition on grazing land in Samosir regency is grassland more dominate pasture land than legumes and even at altitude more than 1205 meters above sea level almost nothing. According to Yasin [3] opinion that during the rainy season, the potential grasses as forages grow well and the biomass production is relatively abundant. However, in the dry season, productivity is relatively small. That is, the limiting factor is the availability of water instead of rain. If water can be adequately supplied throughout the year, the production and availability of forage will not be an obstacle.

The high percentage of grass caused by grass is easy to grow and develop in almost all types of soil and in various types of climate. In addition, grass growth is faster than leguminous. This is because the grasses generally grow to form clumps, have a strong root system that is resistant to stalking and ripping cattle, its rapid regrowth, it is rhizomes creeping and forming new plants rapidly spreading if subjected to cuts by both livestock and defoliation. This is in accordance with the opinion of Hidayati [4] that the cutting period has an effect on the production and quality of grass and grazing production of pastureland.

3.4. Nutrition Content Analysis

Table 5. Nutrient Content Analysis (based on Dry Matter)

| Type of Forage                | Dry Matter | Ash Content | Crude Protein | Crude Fiber | Ether Extract | Beta-N |
|------------------------------|------------|-------------|---------------|-------------|---------------|--------|
| *Eupatorium adenophorum*      | 82.90      | 9.44        | 8.65          | 15.67       | 0.73          | 48.43  |
| *Stylosantes capitata*        | 90.11      | 9.09        | 9.89          | 27.64       | 1.37          | 42.12  |
| *Paspalum conjugatum*         | 91.19      | 6.61        | 9.03          | 35.78       | 0.53          | 39.24  |
| *Cynodon dactylon*            | 91.60      | 9.88        | 8.74          | 29.54       | 0.73          | 42.71  |
| *Flemingia macrofiliu*        | 90.44      | 11.69       | 14.21         | 32.45       | 1.56          | 30.53  |
| *Zoysia matrella*             | 92.69      | 5.51        | 14.53         | 31.86       | 1.55          | 39.24  |
| *Axonopus compressus*         | 91.88      | 10.79       | 10.44         | 28.17       | 1.41          | 41.07  |
| *Imperata cylindrica l*       | 91.30      | 9.40        | 13.21         | 29.02       | 1.68          | 37.99  |
| *Rabba-rabba*                 | 90.25      | 8.27        | 9.17          | 26.82       | 1.63          | 44.36  |
| *Centella asiatica*           | 90.37      | 10.05       | 9.07          | 18.24       | 1.33          | 51.68  |
| *Melastoma malabatricum*      | 91.72      | 5.74        | 11.88         | 26.77       | 0.24          | 47.09  |
| *Mimoso pudica*               | 90.92      | 4.74        | 9.42          | 30.11       | 1.05          | 45.60  |
| *Leptochloa chinensis l*      | 89.54      | 10.56       | 13.88         | 27.06       | 1.22          | 36.82  |
| *Starkuak*                    | 91.12      | 11.08       | 15.13         | 22.83       | 1.32          | 40.76  |
| *Stachytarpheta jamaicencis*  | 90.93      | 5.23        | 14.48         | 18.24       | 0.03          | 52.95  |
Based on analysis of dry matter content, the highest is *Zoysia matrella* 92.69%, followed by *Axonopus compressus* 91.88% and *Melastoma malabatricum* 91.72%. Dry matter highest content of a plant is influenced by soil conditions that experience drought so that forage that grows also experience water crisis so that the BK content of the plant has increased. At location of the study experienced a very long drought so that the crop on the pasture land experienced a water crisis or drought. According to Hidayati [4] that the quality of pastures represented by the amount of crude protein content and dry matter (almost entirely cellulose and hemi-cellulose) also displays large deviations throughout the year. Protein grass in the rainy season reaches 8.3% rapidly decreases to 5.5% at the beginning of the dry season and then falls to the lowest point, 2.2% at the end of the dry season. In the same period the leguminous protein also showed a decrease from 26.5% to 22.3% and so on 12.5%. Dry matter content also showed a large increase, from 20% in the rainy season for both grass and legumes increased sharply to 74% and 43% respectively at the end of the dry season.

4. Conclusions
Botanical composition at altitude of 905–1200 meters above sea level has more diversity that is 31 species with ratio of grass 80.58%, legumes 9.14%, weeds 9.63% and the most dominant is *Imperata cylindrica* l. While, botanical composition at altitude more than 1205 meters above sea level there are 15 species with ratio of grass 92.72%, legumes 2.87%, weeds 4.39% and the most dominant is *Axonopus compressus*. The result of nutrient content analysis which has the highest crude protein is *Starkuak* 15.13%.

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