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# The Effect of Regrowth Period on Yield, Chemical Composition, and Nutritional Value of Panicum Grass

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# The Effect of Regrowth Period on Yield, Chemical Composition, and Nutritional Value of Panicum Grass[1,2]

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Good quality forage is essential for the proper nutrition of ruminants. Quality of forage can be defined in terms of the nutrients which a particular grass contains and the digestibility of these nutrients.

Research has shown that the chemical composition of grasses in temperate regions changes with increase in maturity (*3, 5, 7, 8, 10, 11*). Crude protein, ether extract, nitrogen-free extract, and mineral content decrease and crude fiber content increases as the grasses mature. These changes in composition are known to be associated with decrease in digestibility of the chemical components and reduction in the nutritive value (*3, 5, 10, 11*).

[1]This study was conducted in cooperation with Western Regional Project W-94, Range Livestock Nutrition.

[2]Taken from data presented by the senior author to the Graduate School of the University of Hawaii in partial fulfillment of the requirements for a M.S. degree.

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Grasses grown in subtropical and tropical areas of the world do not have a true dormant period as is characteristic of grasses in temperate zones. These grasses grow year around, although it is recognized that forage production during the winter months is not as high as during the spring and summer.

While some data are available on yield from tropical and subtropical forages, only limited data are available on changes in chemical composition, digestibility of chemical components, and nutritional value of these forages with change in regrowth period. Nordfeldt *et al.* (*6*) studied napier grass (*Pennisetum purpureum*) harvested at six stages of growth and reported a decrease in digestibility as the grass matured. A recent publication from the Hawaii Agricultural Experiment Station (*9*) reported on the chemical composition and nutritive value of kikuyu (*Pennisetum clandestinum*) and pangola (*Digitaria decumbens*) grasses harvested at 3, 6, 9, 12, 18, and 24 weeks regrowth. Data from these trials show a great decrease in nutritive value beyond the 9-week regrowth period.

The trials reported herein were conducted to determine the yield, chemical composition, digestibility of chemical components, and nutritional value of panicum grass (*Brachiaria mutica*) harvested at four regrowth periods.

## EXPERIMENTAL PROCEDURE

The panicum grass was obtained from a 50 x 200-ft area enclosed within a pasture situated at an elevation of approximately 10 feet above sea level on soil of the Pearl Harbor series. The plot consisted of a pure stand of panicum grass with little or no foreign plant material. At the beginning of the experiment, the plot was mowed with a sickle-bar mower and the grass discarded. At intervals of 5, 6, 7, and 8 weeks (Trial 1) and 4, 6, 8, and 10 weeks (Trial 2), strips were cut from the experimental plot.

At time of harvesting, an area 10 x 10 feet was cut with hand sickles, and the grass weighed to determine yield. The remainder of the strip was cut using a sickle-bar mower. Approximately 500 pounds of grass were harvested for each regrowth period.

After harvesting, the grass was chopped into approximately one-inch pieces and placed in polyethylene bags. The grass was frozen in a −5 to −10°F. freezer, then stored in a freezer at 23 to 25°F. until used in digestion trials.

The panicum grass was clipped on June 6 and harvested on July 11, 18, 25, and August 2, 1962 (Trial 1). The last cutting was delayed one day because of rain. For the second trial, the panicum grass was clipped on March 4 and harvested on April 1, 15, 29, and May 13, 1964.

The nutritive value of each grass was determined by means of digestion trials. The trials were conducted using wethers in metabolic cages. Four animals were put on trial for the evaluation of each cutting of grass.

The trial period was 21 days. During the first week, animals were fed free choice to establish voluntary consumption. After establishing a constant intake for each animal, a preliminary period and a collection period of 7 days each followed. During the 7-day collection period, feces were collected daily, weighed, and dried in a forced-air oven at 65° to 70°C. for 72 hours.

The grasses to be fed during the digestion trials were prepacked into bags and kept frozen until fed. Grab samples were taken for chemical analyses at the time of packing.

The chemical composition of the grasses and feces was determined by methods of the Association of Official Agricultural Chemists (*1*) and included dry matter, protein, crude fiber, ether extract, and nitrogen-free extract. Caloric values were determined using a Paar oxygen bomb calorimeter. Calcium content was determined by a titrimetric method designed for plants, as outlined by A.O.A.C. (*1*). Phosphorus content was determined by the method of Jackson (*2*).

## RESULTS AND DISCUSSION

The results of the chemical analysis of panicum grass cut at four stages of regrowth are shown in Tables 1 and 2. On the dry matter basis (Table 1), crude protein and phosphorus decreased with increase in regrowth period. The crude fiber and nitrogen-free extract both increased with increase in regrowth period. The ether extract and ash content decreased with increase in regrowth period for the first trial. In the second trial, the change in ether extract and ash content with increase in regrowth period was less clearly defined. Gross energy values were very consistent in the first trial and showed a slight decrease with interval of regrowth period in the second trial.

TABLE 1. Chemical composition of panicum grass–dry matter basis

| Trial | Regrowth period | Crude protein | Ether extract | Crude fiber | Ash | Nitrogen-free extract | Calcium | Phosphorus | Gross energy |
|---|---|---|---|---|---|---|---|---|---|
| | weeks | % | | | | | | | Cal/gm |
| 1 | 5 | 10.50 | 2.39 | 31.20 | 12.55 | 43.36 | 0.22 | 0.29 | 4133 |
| | 6 | 9.76 | 2.30 | 31.26 | 12.04 | 44.64 | 0.19 | 0.27 | 4142 |
| | 7[1] | 7.97 | 2.26 | – | 11.88 | – | – | – | 4124 |
| | 8 | 6.87 | 1.80 | 33.05 | 10.71 | 47.57 | 0.17 | 0.19 | 4144 |
| Average | | 8.78 | 2.19 | 31.84 | 11.80 | 45.19 | 0.19 | 0.25 | 4136 |
| 2 | 4 | 18.75 | 3.04 | 25.92 | 14.51 | 37.78 | 0.30 | 0.34 | 4159 |
| | 6 | 11.77 | 1.58 | 33.46 | 14.83 | 38.36 | 0.27 | 0.26 | 4042 |
| | 8 | 8.93 | 1.80 | 33.68 | 14.50 | 41.08 | 0.34 | 0.21 | 3986 |
| | 10 | 6.90 | 1.40 | 35.35 | 13.52 | 42.83 | 0.22 | 0.16 | 3988 |
| Average | | 11.59 | 1.96 | 32.10 | 14.34 | 40.01 | 0.28 | 0.24 | 4044 |

[1] Crude fiber, calcium, and phosphorus were not determined on this sample.

TABLE 2. Chemical composition of panicum grass—original moisture basis

| Trial | Regrowth period | Dry matter | Crude protein | Ether extract | Crude fiber | Ash | Nitrogen-free extract | Calcium | Phosphorus | Gross energy |
|---|---|---|---|---|---|---|---|---|---|---|
| | weeks | % | | | | | | | | Cal/gm |
| | 5 | 20.80 | 2.18 | 0.50 | 6.49 | 2.61 | 9.02 | 0.05 | 0.06 | 860 |
| | 6 | 23.10 | 2.25 | 0.53 | 7.22 | 2.78 | 10.31 | 0.04 | 0.06 | 957 |
| 1 | 7 [1] | 24.73 | 1.97 | 0.56 | – | 2.94 | – | – | – | 1020 |
| | 8 | 24.34 | 1.67 | 0.44 | 8.04 | 2.61 | 11.58 | 0.04 | 0.05 | 1009 |
| Average | | 23.24 | 2.02 | 0.51 | 7.25 | 2.74 | 10.30 | 0.04 | 0.06 | 962 |
| | 4 | 14.46 | 2.71 | 0.44 | 3.75 | 2.10 | 5.46 | 0.04 | 0.05 | 601 |
| | 6 | 15.28 | 1.80 | 0.24 | 5.11 | 2.27 | 5.86 | 0.04 | 0.04 | 618 |
| 2 | 8 | 18.74 | 1.67 | 0.34 | 6.31 | 2.72 | 7.70 | 0.06 | 0.04 | 747 |
| | 10 | 27.20 | 1.88 | 0.38 | 9.61 | 3.68 | 11.65 | 0.06 | 0.04 | 1085 |
| Average | | 18.92 | 2.02 | 0.35 | 6.20 | 2.69 | 7.67 | 0.05 | 0.04 | 763 |

[1] See Table 1.

The chemical composition of panicum grass on the original moisture basis (Table 2) shows the same trend as observed in Table 1 for crude fiber and nitrogen-free extract. The protein content shows the same trend, in that it is higher in the early cuttings at 5 and 6 weeks in Trial 1 and at 4 weeks in Trial 2 than later cuttings. The ether extract showed no definite trend. Gross energy increased with increase in regrowth period.

Digestion coefficients are shown in Table 3. The digestibility of dry matter, crude protein, crude fiber, nitrogen-free extract, and gross energy decreased with interval of regrowth period. Greater changes were observed in the second trial, probably because of the longer interval between cuttings.

The change in chemical composition and the reduction in digestibility of the chemical constituents resulted in a decrease in nutritive value with increase in regrowth period. These data are shown in Table 4. On both the dry matter basis and original moisture basis, the digestible protein content decreased with increase in regrowth period. In Trial 1, it decreased from 7.33 to 3.89% within a period of 3 weeks, while in Trial 2 the digestible protein decreased from 15.14 to 4.74% within a period of 6 weeks. On a dry matter basis, total digestible nutrients and digestible energy decreased rapidly following the 6-week harvest period in both trials. On the original moisture basis, the total digestible nutrient and digestible energy content did not change much with change in regrowth period. The increase in dry matter content with increase in regrowth period was accompanied by decreased digestibility of dry matter. This resulted in the total digestible nutrients on the original moisture basis being about the same for the different regrowth periods.

Total yield, dry matter, digestible protein, and total digestible nutrient yield per acre are shown in Table 5. In the first trial, total yield and dry matter yield increased with each successive cutting. In Trial 2, total yield was maximum at 6 weeks and remained about the same for the 8- and 10-week cuttings. Dry matter yield increased with each successive cutting in both trials. Digestible protein yield per acre reached a maximum at 6 to 7 weeks in Trial 1 and at 6 weeks in Trial 2. Yield of total digestible nutrients increased with increase in regrowth period in Trial 1 but showed variation from this in Trial 2.

TABLE 3. Digestion coefficients of panicum grass

| Trial | Regrowth period | Dry matter | Crude protein | Ether extract | Crude fiber | Nitrogen-free extract | Gross energy |
|---|---|---|---|---|---|---|---|
| | weeks | % | | | | | Cal/gm |
| | 5 | 65.39 | 69.81 | 53.91 | 68.63 | 68.10 | 65.16 |
| | 6 | 64.71 | 66.01 | 50.61 | 69.16 | 68.50 | 64.56 |
| 1 | 7[1] | 60.00 | 64.97 | – | – | – | 59.26 |
| | 8 | 59.56 | 56.61 | 55.95 | 62.00 | 62.33 | 58.79 |
| Average | | 62.42 | 64.35 | 53.49 | 66.60 | 66.31 | 61.94 |
| | 4 | 69.65 | 80.74 | 45.51 | 74.03 | 69.23 | 69.58 |
| | 6 | 66.07 | 71.77 | 37.42 | 72.26 | 66.09 | 65.17 |
| 2 | 8 | 57.25 | 60.96 | 46.18 | 56.27 | 49.73 | 55.50 |
| | 10 | 51.53 | 53.93 | 44.46 | 53.70 | 49.00 | 50.28 |
| Average | | 61.12 | 66.85 | 43.39 | 64.06 | 58.51 | 60.13 |

[1]See Table 1.

TABLE 4. Nutritive value of panicum grass

| Trial | Regrowth period | Dry Matter Basis | | | Original Moisture Basis | | |
|---|---|---|---|---|---|---|---|
| | | Digestible crude protein | Total digestible nutrients | Digestible energy | Digestible crude protein | Total digestible nutrients | Digestible energy |
| | weeks | % | % | Cal/gm | % | % | Cal/gm |
| 1 | 5 | 7.33 | 61.17 | 2693 | 1.54 | 12.83 | 560 |
| | 6 | 6.44 | 61.26 | 2674 | 1.45 | 13.79 | 618 |
| | 7[1] | 5.18 | 55.94 | 2444 | 1.29 | 13.90 | 604 |
| | 8 | 3.89 | 56.32 | 2436 | 0.97 | 13.97 | 593 |
| Average | | 5.71 | 58.67 | 2562 | 1.31 | 13.62 | 594 |
| 2 | 4 | 15.14 | 63.59 | 2894 | 2.19 | 9.19 | 418 |
| | 6 | 8.44 | 59.13 | 2634 | 1.29 | 9.03 | 402 |
| | 8 | 5.44 | 46.70 | 2212 | 1.02 | 8.75 | 414 |
| | 10 | 3.72 | 45.04 | 2005 | 1.01 | 12.25 | 545 |
| Average | | 8.18 | 53.62 | 2436 | 1.38 | 9.80 | 445 |

[1] Total digestible nutrient content was calculated using the method outlined by Lofgreen (*4*).

TABLE 5. Yield of dry matter and nutrients from panicum grass

| Trial | Regrowth period | Total yield | Dry matter | Digestible protein | Total digestible nutrients |
|---|---|---|---|---|---|
| | weeks | | lb per acre | | |
| | 5 | 14,810 | 3,080 | 226 | 1,884 |
| | 6 | 17,206 | 3,975 | 256 | 2,435 |
| 1 | 7[1] | 20,691 | 5,092 | 264 | 2,848 |
| | 8 | 25,047 | 6,096 | 237 | 3,433 |
| Average | | 19,438 | 4,561 | 246 | 2,650 |
| | 4 | 12,066 | 1,745 | 264 | 1,110 |
| | 6 | 35,850 | 5,478 | 462 | 3,239 |
| 2 | 8 | 32,757 | 6,139 | 334 | 2,867 |
| | 10 | 33,498 | 9,111 | 339 | 4,104 |
| Average | | 28,543 | 5,618 | 350 | 2,830 |

[1]See Table 4.

## SUMMARY

Two trials were conducted to determine the yield, chemical composition, digestibility of chemical components, and nutritional value of panicum grass harvested at four regrowth periods. Intervals of regrowth studied were 5, 6, 7, and 8 weeks (Trial 1) and 4, 6, 8, and 10 weeks (Trial 2). Wethers were used to obtain digestibility data.

The data show that the chemical composition of panicum grass changes with increase in regrowth period. The major changes of nutritional significance are the decrease in crude protein and the increase in crude fiber. Associated with the changes in composition are changes in digestibility. With increase in regrowth period, the digestibility of dry matter, crude protein, crude fiber, nitrogen-free extract, and gross energy decreases. These changes result in a decrease in the nutritive value of panicum grass with increase in regrowth period.

Considering yield data (Table 5) as well as nutritional value (Table 4), these data would suggest that panicum grass should be used at about 6 weeks' regrowth.

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