

THE NUTRITIVE VALUES OF SOME FORAGE CROPS OF PUERTO RICO¹

III. Grasses, Legumes and Mixtures

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This paper is a report of data collected during the performance of seventeen digestion trials with native sheep, as a continuation of the studies of the nutritive values of forage crops begun three years ago.

Our previous publications give the details of the experimental procedures followed, and may be referred to.

MATERIALS

The forage crops studies and the trials conducted with each were as follows: Three trials with cow peas of which the first was conducted when the plant was beginning to bloom, the second during the full bloom stage, and the third during the full pod stage; three trials with Merker grass collected just after the blooming stage; one with "Yaraguá" grass during the blooming stage; two with Para grass just after the blooming stage; three with alfalfa hay which was not completely dried; one with a mixture consisting of 2/3 Merker grass and 1/3 pigeon pea in the full bloom stage; one with another mixture consisting of 2/3 Para grass and 1/3 pigeon pea in the full bloom stage; and three trials with a low nitrogen synthetic ration used for the purpose of determining the protein maintenance requirements of all the sheep used in the above trials.

¹ Cooperative project between the Agricultural Experiment Station of the University of Puerto Rico and the School of Tropical Medicine.

Data and Discussion

The schedule followed during the course of the studies is given in Table 1.

Table 2 gives the weights of the wet and dry feed consumed or refused and the feces eliminated, the volumes of water the sheep drank and that of the urine voided during each of the ten-day trials. Except in the trial with the alfalfa hay, it will be noticed that the water intake is low compared with the urine voided. This is accounted for by the fact that the crops, as brought from the field, were wet with either rain or dew, while the alfalfa had been partially dried and stored.

Tables 3 and 4 contain data collected during the low protein trials performed to determine the protein maintenance requirements of our sheep. Various synthetic rations were tried, some of which were entirely refused or eaten sparingly by the animals. The final rations used, from which the data herein reported were collected, had the following compositions.

Rations	Trial 15	Trials 16 and 17
Merker grass straw ¹ -----	20 %	50%
Sucrose, brown -----	21.4%	15%
Corn starch -----	21.4%	25%
Steamed bone meal -----	2.0%	5%
Corn oil -----	1.3%	3%
Cellu flour -----	33.9%	—
Sodium chloride -----	—	2%

The elimination of the Cellu flour, the decrease in the percentage of sucrose and the addition of salt seemed to produce a more appetizing ration. The values obtained for the fecal nitrogen per gram of dry matter ingested and the urinary nitrogen per kilogram of body weight compare favorably with the previously obtained values.

The percentages by weight, determined on the dry basis, of the nitrogen in the feeds fed, feeds refused, and feces and urine eliminated (the values for the latter being expressed in percentages by volume), are given in Table 8, while Table 9 contains the chemical analyses of the feces as determined on the dry basis.

¹ Prepared in the laboratory by removing all the leaves from the air dried grass, cleaning the stems and then grinding them.

A summary of the data collected during the digestion trials upon which the calculations of the biological values of the proteins of the grasses and legumes studied is given in Table 10. The biological value of the protein of the cow pea increases as the plant changes from the just before blooming stage through the full bloom to the full pod stages. The Para grass protein gave a higher biological value than the Merker grass protein, both having been harvested during the same stage of maturity. In the cases of the mixtures, the Para grass—pigeon pea mixture gave a higher biological value for protein than the Merker grass—pigeon pea mixture.

Table 11 contains data relative to the digestible nutrients per 100 pounds of legumes and grasses as harvested for our trials. Among the legumes, we find that the alfalfa hay yields the highest total digestible nutrients together with a narrow nutritive ratio. Among the grasses, Yaraguá grass has the highest total digestible nutrients, but a very wide nutritive ratio.

The digestible nutrients produced per cuerda¹ of the grasses and legumes are found in Table 12, while Table 13 gives us the yields of calcium and phosphorus per cuerda and per ton of green legumes and grasses.

The net protein values of the legumes and grasses studied, fed singly or in mixtures, are given in Table 14. These values are of importance in calculating the weight of any feed necessary to maintain an animal in nitrogen equilibrium or to supply the requirements for milk production or growth. The grasses may be arranged in the following order of decreasing efficiency as regards their net-protein values if we collect all the data made available in this and previous studies: 1. Guinea grass, 0.80; 2. Merker grass, 0.78; 3. Para grass, 0.70; 4. Elephant grass, 0.64; 5. Guatemala grass, 0.64; and Yaraguá grass, 0.34.

The data of the nitrogen balance in grams as the percentage of the total intake are used to calculate the total nitrogen stored by the animals, and are contained in Table 15.

A summary of the indexes determined during the trials is given in Table 16.

The vitamin A activities of the grasses studied were also determined. The results given in Table 17 were obtained during the last two years.

¹ One "cuerda" = 0.9712 acre.

SUMMARY AND CONCLUSIONS

The data for a total of seventeen digestion trials with sheep receiving grasses, legumes, two mixtures of these, and low protein synthetic mixtures as sole rations are reported.

The biological values for the proteins of the cow pea increase as the plant passes from the just before blooming stage through the full bloom to the full pod stages of maturities. The biological values for proteins are also higher for the grasses than for the legumes when fed singly.

The grasses studied during the last three years can be arranged in the following order of decreasing net-protein values: Guinea, Merker, Para, Elephant, Guatemala and Yaraguá.

The nutritive ratio for the Yaraguá grass is very wide due to the low digestible protein, as is shown in the data.

Alfalfa hay yields more total digestible nutrients, more crude fiber and more ether soluble extract than any of the other legumes studied.

The percentage intake of protein stored is greater with a mixture of Merker grass and pigeon pea than when the grass is fed alone.

The vitamin A activities of some grasses and legumes are reported.

LITERATURE CITED

1. Axtmayer, Joseph H., Conrado F. Asenjo, Jr., and D. H. Cook: Jour. Agric. Univ. P. R. 22 (2) ; 95-122, 1938.
2. Axtmayer, Joseph H., G. Rivera Hernández, and D. H. Cook: Ditto. 22 (4) ; 455-481, 1938.