

COMPARISON OF CHROMOGEN METHOD WITH STANDARD DIGESTION TRIAL FOR DETERMINATION OF THE DIGESTIBLE NUTRIENT CONTENT OF KIKUYU GRASS AND RAMIE FORAGES WITH SHEEP

ROBERT L. SQUIBB,¹ CARLOS RIVERA² AND ROBERTO JARQUIN²

THE importance of increasing the production of high protein forages in Central American areas has been stressed. Kikuyu grass (*Pennisetum clandestinum*) and ramie (*Boehmeria nivea*), which can be grown throughout the American Tropics, have been shown to be of high nutritive value in animal diets (Squibb *et al.*, 1953 and Squibb *et al.*, 1954). Kikuyu grass grows at altitudes from 3,000 to 12,000 feet while ramie, which is an important fiber crop in Southern Florida, grows from sea level to 6,000 feet altitude. Little is known, however, of the digestible nutrient content of these forages especially when grown under Guatemalan conditions.

In these studies, digestion coefficients were determined for kikuyu grass and ramie forages using sheep in standard digestion trials, and the data were compared with those obtained simultaneously by the chromogen method of Reid *et al.* (1950).

Methods

Five yearling wethers, of approximately the same age and weight and of the breeding, Criollo 25% x Navajo 25% x Hampshire 50%, were selected for the digestion studies. These sheep were grazing either kikuyu grass or ramie at least one month before the corresponding trials. Standard fecal collection harnesses, modified to hold changeable plastic bags, were employed. During the trials the sheep were kept in small all-concrete pens.

In each trial there was a preliminary period of 7 days during which the animals received the test forage and water *ad libitum* under the actual conditions to be used in the experiment. Following this, each animal was fed a constant weight of the test forage over a 7-day period. Representative samples of each forage were obtained daily. The plastic bag inserts for collecting the feces were removed twice daily and the feces placed in sealed glass containers which were stored under refrigeration until analyzed. Forage and fecal samples were analyzed at the end of each digestion trial, and the calculation of the digestion coefficients was made by standard methods (Maynard, 1947). The same forage and fecal samples of these studies were also analyzed by the chromogen method of Reid *et al.* (1950), and these data used for comparison with the standard procedure.

The kikuyu grass was collected prior to maturity (less than 5 in. in

¹ Consultant in Animal Nutrition, Instituto de Nutricion de Centro America y Panama (INCAP), Guatemala, C. A. Present address, Dept. of Poultry Science, Rutgers University, New Brunswick, N. J.

² Servicio Cooperativo Interamericano de Agricultura (SCIDA), Guatemala, C. A. INCAP Scientific Publication I-89.

TABLE 1. CHEMICAL COMPOSITION OF KIKUYU GRASS AND RAMIE FORAGES (DRY BASIS)

Forage	Protein	Fat	NFE ^a	Crude fiber	Ash
	%	%	%	%	%
Kikuyu grass	15.18	4.31	28.57	39.30	12.64
Ramie, sample 1	20.57	2.74	44.12	16.77	15.80
Ramie, sample 2	19.48	2.53	23.38	37.99	16.62

^a NFE=Nitrogen-free extract.

height) while the ramie samples were collected at the recommended height of 20 in. (Squibb *et al.*, 1954). Ramie sample 1 was collected in the rainy season and sample 2 during the dry season. Laboratory analysis of the forages and fecal samples were made by methods recommended by the A.O.A.C. (1950).

Results and Discussion

The chemical composition of the forages is presented in table 1. The data show these non-legume forages to be excellent sources of protein. The difference in fiber content of the two ramie forage samples was due

TABLE 2. COMPARISON OF THE DIGESTION COEFFICIENTS OF KIKUYU GRASS AND RAMIE FORAGES DETERMINED WITH SHEEP BY THE STANDARD DIGESTION TRIAL (STD) AND CHROMOGEN PROCEDURES (CHROM)

Sheep number	Protein %		Fat %		NFE ^a %		Crude fiber %	
	Chrom.	Std.	Chrom.	Std.	Chrom.	Std.	Chrom.	Std.
Kikuyu grass forage								
1	64.7	62.1	57.0	53.9	69.6	67.9	67.7	65.4
2	67.6	64.3	63.8	60.2	76.9	74.5	65.8	62.4
3	60.2	60.6	57.7	58.1	74.0	74.3	64.9	65.4
4	59.5	59.9	58.1	58.6	77.0	77.3	58.0	58.5
5	61.7	60.9	55.0	54.2	72.5	71.9	62.8	62.1
Average	62.7	61.6	58.3	57.0	74.0	73.2	63.8	62.8
S. D.=	3.37	1.73	3.29	2.81	3.12	3.52	3.71	2.86
Ramie forage, sample 1								
1	59.3	86.8	26.2	58.0	78.0	93.0	36.8	55.0
2	55.9	85.6	33.4	56.0	71.0	91.0	27.7	59.0
3	44.0	84.0	58.2	54.0	46.8	83.0	21.0	77.0
4	62.6	85.0	15.4	54.0	79.1	92.0	21.0	69.0
5	55.6	85.0	34.0	53.0	68.7	89.0	3.4	64.0
Average	55.5	85.3	33.4	55.0	68.7	89.6	22.0	64.8
S. D.=	7.02	1.02	15.74	2.00	13.03	3.97	12.24	8.61
Ramie forage, sample 2								
1	68.8	85.0	2.6	54.0	39.8	88.0	74.5	71.0
2	68.6	83.0	9.6	49.0	71.8	79.0	62.9	84.0
4	69.5	81.0	18.3	48.0	36.0	89.0	82.6	59.0
5	69.7	83.0	9.6	49.0	77.4	73.0	52.4	87.0
Average	69.2	83.0	10.0	50.0	56.2	82.2	68.1	75.2
S. D.=	0.53	1.63	6.43	2.71	21.37	7.63	13.23	12.87

^a NFE=Nitrogen-free extract.

to the age of the plants at the time of collection. Ramie grows to 20 in. in height more rapidly in the rainy season. The digestion coefficients, table 2, show that the nutrients of kikuyu grass are digested to about the same extent as those of Red top (*Agrostis alba*). The digestion coefficients of ramie for protein, fat, nitrogen-free extract and crude fiber were superior to those of alfalfa and most clovers. The unusually high digestibility of the protein of this plant is further confirmation of its high nutritive value (Squibb *et al.*, 1953). Calculations of the digestible nutrient content of kikuyu and ramie forages are presented in table 3.

The results, table 2, show that there was excellent agreement between the data of the standard digestion trial and those obtained by the chromogen method for kikuyu grass. For the ramie forage samples, however, the two methods were not comparable. In the case of both ramie samples, the data

TABLE 3. DIGESTIBLE NUTRIENT COMPOSITION OF KIKUYU GRASS AND RAMIE FORAGES (DRY BASIS)

Forage	Protein	Fat	NFE ^a	Crude fiber	TDN
	%	%	%	%	%
Kikuyu grass	9.41	5.54	20.86	24.76	60.57
Ramie, sample 1	17.48	3.40	39.70	10.90	71.48
Ramie, sample 2	16.17	2.86	19.17	28.49	66.69

^a NFE=Nitrogen-free extract.

obtained with the chromogen method were not only highly variable but yielded results which were significantly lower than those observed in the standard digestion trial. Apparently part of the chromogenic material in ramie is digestible. Since there is a possibility that forages, other than ramie, may also contain digestible chromogens, this method should not be used for determining the digestibility of little known or unknown tropical forages. The data do indicate that the chromogen method could be used for range studies with kikuyu grass.

Summary

Comparison of the chromogen method with standard digestion trials using sheep showed excellent agreement for kikuyu grass (*Pennisetum clandestinum*) and highly variable, low results for ramie (*Boehmeria nivea*). These results preclude the use of the chromogen method for determination of digestion coefficients of little known or unknown tropical forages.

Both forages were similar to legumes in crude protein. The digestible nutrient content of kikuyu grass is similar to that of Red top (*Agrostis alba*), while that of ramie is equal or superior to alfalfa and most clovers.

Literature Cited

- Association of Official Agricultural Chemists. 1950. Official Method of Analysis. 7th ed., Washington, D.C.
- Maynard, L. A. 1947. Animal Nutrition. McGraw-Hill Book Co., Inc., New York and London.
- Reid, J. T., P. G. Woolfolk, C. R. Richards, R. W. Kaufmann, J. K. Loosli, K. L. Turk, J. I. Miller and R. E. Blaser. 1950. A new indicator method for the determination of digestibility and consumption of forages by ruminants. *J. Dairy Sci.* 33:60.
- Squibb, R. L., M. Guzman and N. S. Scrimshaw. 1953. Dehydrated desmodium, kikuyu grass, ramie and banana leaf forages as supplements of protein, riboflavin and carotenoids in chick rations. *Poul. Sci.* 32:1078.
- Squibb, R. L., J. Mendez, M. A. Guzman and N. S. Scrimshaw. 1954. Ramie—a high protein forage crop for tropical areas. *Brit. Grasslands Soc.* 9:313.