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## Some Effects of Calcium and Phosphorus Fertilization on the Yield and Composition of a Tropical Kudzu-Grass Pasture

*Fernando Abruña and Jacinto Figarella<sup>1</sup>*

### INTRODUCTION

Tropical kudzu-grass pastures constitute the basis for an extensive livestock-development program currently under way in the Mountain Region of Puerto Rico. The work of Loustalot and Telford (4)<sup>2</sup> and of Landrau, Samuels, and Rodriguez (3) presents often conflicting evidence on the effect of lime and phosphorus applications to tropical kudzu growing alone. In the experiments of Bonnet, Riera, and Roldán (1) tropical kudzu growing in association with Napier, Guinea, and Pará grasses on an acid soil, did not respond to liming. Of the grasses, only Napier responded in yield to liming. In these studies the addition of lime increased the calcium content of the grasses but did not affect that of kudzu. Phosphorus applications did not affect the content of this nutrient in any of the forages. Vicente, Caro, and Figarella (8) found that kudzu-molasses grass pastures growing on a shallow Múcara soil in the Mountain Region did not respond to phosphorus applications. On the other hand, these investigators found that the early growth rate of tropical kudzu growing alone on an acid soil of the Mountain Region was increased by fertilization with phosphorus (7).

### OBJECTIVE AND METHODS USED

The purpose of this study was to determine the effect of calcium and phosphorus fertilization on the yield and composition of a tropical kudzu-molasses grass-Guinea grass pasture growing under conditions typical of the Mountain Region of Puerto Rico.

The experiment was carried out over a period of 2 years at Orocovis. The soil is a deep, red, Catalina clay with a pH of 4.8. The cation-exchange capacity and exchangeable-base content of the soil were 17.4 and 5.5 m.e.

<sup>1</sup> Soil Scientists of a cooperative project between the Agricultural Research Service of the U. S. Department of Agriculture and the Agricultural Experiment Station, University of Puerto Rico, Río Piedras, P. R.

<sup>2</sup> Italic numbers in parentheses refer to Literature Cited, pp. 234-5.

per 100 gm. of soil, respectively. The organic-matter content averaged 4.3 percent and the nitrogen content 0.3 percent. Soil phosphorus was determined by the Truog (6), Dickman and Bray (2), and Olsen (5) methods, which yielded 150, 54, and 24 pounds per acre, respectively.

The field was planted with kudzu and molasses grass by broadcasting their seed. Guinea grass was seeded in rows 4 feet apart with 4 feet between clumps. All treatments were replicated four times using a split-plot design with the lime variable tested in the main plots, and the phosphorus levels in the subplots. Individual plots were 20 by 10 feet in size. Phosphorus from 21-percent superphosphate was applied at rates of 0, 45, and 90 pounds of phosphorus per acre yearly, and calcium (from calcium hydroxide) not at all, or at a rate of 1,300 pounds per acre at the beginning of the experiment.

The herbage in all plots was harvested every 2 months, weighed, and removed from the experimental area. Samples from all plots were taken to the laboratory, dried, and analyzed for crude protein ( $N \times 6.25$ ) using standard methods. The calcium and phosphorus content of samples composited from plots of similar treatment were determined at each harvest.

## RESULTS

The results of this study are summarized in table 1. The pasture mixture yielded an average of 12,938 pounds of dry matter per acre yearly having a crude-protein content of 8.5 percent, a calcium content of 0.56 and a phosphorus content of 0.26 percent. Tropical kudzu contributed about 14 percent of the forage produced by the mixture as compared to 23 for molasses grass and 63 for Guinea grass.

Tropical kudzu had more than twice the protein, 16.8 percent, and calcium, 1.11 percent, content of the grasses. On the average, Guinea grass had a somewhat higher calcium content than molasses grass, 0.50 as compared with 0.38 percent. Molasses grass had a higher average phosphorus content than either kudzu or Guinea grass.

Liming increased the protein content of tropical kudzu significantly, from 15.2 to 17.8 percent. Lime alone or in combination with 45 pounds of phosphorus per acre increased the yields of kudzu significantly. Liming had no apparent effect on the yield or protein content of the grasses or on the calcium or phosphorus content of any of the forages.

Phosphorus applications had no apparent effect on the yield, or the calcium or protein contents of any of the forages. The yearly application of 45 pounds per acre of phosphorus, however, resulted in an increase in the phosphorus content of composite samples of both grasses at all harvests, but had no appreciable effect on the phosphorus content of the kudzu. No further increase in phosphorus content of the grasses attributable to the heavier application of this nutrient was evident.

TABLE 1.—The effect of calcium and phosphorus fertilization on the yield, protein, calcium, and phosphorus contents of a tropical kudzu-molasses grass-Guinea grass pasture mixture growing on a deep, red, acid Catalina clay at Procovis, P. R., over a 2-year period<sup>1</sup>

Treatment <sup>2</sup>	Kudzu			Molasses grass			Guinea grass			Entire pasture mixture						
	Annual dry-matter yield per acre	Protein	Ca	P	Annual dry-matter yield per acre	Protein	Ca	P	Annual dry-matter yield per acre	Protein	Ca	P				
	Lb.	Percent	Percent	Percent	Lb.	Percent	Percent	Percent	Lb.	Percent	Percent	Percent				
Check	1,257	15.0	1.05	0.21	2,875	7.3	0.37	0.27	7,372	7.1	0.43	0.19	11,504	8.0	0.49	0.21
P <sup>1</sup>	1,662	14.9	1.10	.24	2,750	7.3	.39	.33	7,312	7.1	.55	.26	11,724	8.3	.59	.27
P <sup>2</sup>	1,772	16.2	1.06	.25	2,807	7.9	.39	.34	8,215	6.6	.53	.31	12,744	8.2	.57	.31
Average without Ca	1,564	15.2	1.07	0.23	2,811	7.5	0.38	0.31	7,633	6.9	0.51	0.25	11,990	8.2	0.55	0.26
Ca <sup>3</sup>	1,880	17.4	1.12	0.24	2,697	7.7	0.37	0.23	7,377	6.8	0.47	0.19	11,954	8.7	0.55	0.21
Ca + P <sup>1</sup>	2,160	18.1	1.14	.24	2,620	8.3	.38	.33	8,347	7.4	.52	.27	13,727	9.3	.59	.28
Ca + P <sup>2</sup>	1,790	18.0	1.16	.28	3,185	8.2	.37	.36	7,760	7.4	.52	.26	12,735	9.1	.57	.28
Average with Ca	1,943	17.8	1.15	0.26	2,834	8.1	0.38	0.31	7,828	7.2	0.50	0.24	12,805	8.9	0.56	0.26
Over-all average	1,745	16.8	1.11	0.25	2,822	7.8	0.38	0.31	7,731	7.1	0.50	0.25	12,398	8.5	0.56	0.26

<sup>1</sup> All percentages on a dry-weight basis.

<sup>2</sup> P<sup>1</sup>—45 lb. per acre from 21-percent superphosphate applied yearly; P<sup>2</sup>—90 lb. per acre from 21-percent superphosphate applied yearly.

<sup>3</sup> Ca—1,300 lb. per acre from Ca(OH)<sub>2</sub> at beginning of experiment.

## SUMMARY

A tropical kudzu-molasses grass-Guinea grass pasture mixture growing on a deep, red, acid soil in the Mountain Region of Puerto Rico yielded an average of 12,938 pounds of dry forage per acre yearly with a crude-protein content averaging 8.5 percent, a calcium content of 0.56, and a phosphorus content of 0.26 percent.

Liming increased the yield and protein content of tropical kudzu, but did not appreciably affect its calcium or phosphorus content. Liming did not affect the yield, or the protein, calcium, or phosphorus contents of the grasses.

Applications of phosphorus had no apparent effect on the yield, or the protein or calcium contents of the forages. The application of 45 pounds of phosphorus per acre yearly, however, increased the phosphorus content of composite samples of the grasses over all yield periods, but not that of tropical kudzu.

The results of this experiment suggest the desirability of making light applications of lime and phosphorus to kudzu-grass pastures growing on red, acid soils in the Mountain Region of Puerto Rico.

## RESUMEN

Una combinación de Kudzú Tropical con yerba melao y Guinea, creciendo en un suelo rojo, ácido y profundo de la región montañosa de Puerto Rico, produjo un promedio de 12,398 libras de forraje seco por cuerda anualmente, con un contenido de 8.5 por ciento de proteína, 0.56 por ciento de calcio y 0.26 por ciento de fósforo.

El rendimiento y el contenido de proteína del kudzú aumentaron cuando se aplicó cal, pero aparentemente no se afectó su contenido de calcio ni fósforo. Este tratamiento no afectó el rendimiento ni el contenido de proteínas, calcio o fósforo de las yerbas.

Las aplicaciones de fósforo aparentemente no afectaron el rendimiento ni el contenido de proteína y calcio de ninguna de las tres forrajeras. Sin embargo, la aplicación de 45 libras de fósforo por cuerda anualmente trajo un aumento en el contenido de este nutriente en muestras compositadas de las yerbas en todas las épocas, pero no así el del kudzú tropical.

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