Comparative Productivity of Merker Grass and of a Kudzu-Merker Grass Mixture as Affected by Season and Cutting Height

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INTRODUCTION

Elephant grass (*Pennisetum purpureum*) of which Merker is a variety, is widely recognized as the outstanding soilage grass of the humid Tropics. Tropical kudzu (*Pueraria phaseoloides*) is the only forage legume of economic importance in Puerto Rico and its use is spreading rapidly throughout tropical America, largely as a result of the research conducted in Puerto Rico (1).[2] When grown together these forages have outyielded all other grass-legume mixtures tested in an experiment being conducted by R. Freyre and coworkers (2). During the first year of a grazing experiment being conducted by Caro and Vicente (3), pastures seeded to these forages carried over two head per acre and produced approximately 1,100 pounds of beef per acre yearly on steep slopes in the humid mountain region of Puerto Rico. This is by far the highest beef yield ever obtained from pastures under similar conditions in Puerto Rico. However, since these pastures are difficult to manage, their use cannot be recommended until further research is performed.

Vicente, Silva, and Figarella (3) have shown that Merker grass growing alone in the humid region of the Island responds almost linearly in yield to nitrogen applications of up to 800 pounds of this nutrient per acre yearly. At this level Merker grass produced 130 tons of green forage (23 tons of dry matter) annually per acre during the first year, or enough to feed six mature animals per acre if the forage were fully utilized.

There are no data available comparing the productivity of Merker grass well fertilized with nitrogen with that of a kudzu-Merker grass association, or on the growth of these forages during different seasons of the year in the mountain region of Puerto Rico. Neither is information available on the effect of heights of cutting on yields of Merker grass. Vicente and Caro (4) however, have shown that yields of tropical kudzu are reduced by repeated close cutting.

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[2] Numbers in parentheses refer to Literature Cited in pp. 150–1.

OBJECTIVE

The purpose of the present study was to determine the relative yields of Merker grass well fertilized with nitrogen, and of a kudzu-Merker grass association, as affected by cutting height and season of the year, when harvested for use as soilage.

MATERIALS AND METHODS

This experiment was carried out over a period of 2 years at Orocovis, P. R., which lies at an elevation of about 2,000 feet above sea level. Conditions here are typical of the mountain region of the Island where lies the greatest potential for livestock production. The annual rainfall is about 70 inches, the mean annual temperature is about 80°F., and the mean seasonal variation in temperature is about 10°F.

The soil is a deep-red, kaolinitic Catalina clay with a slope of about 25 percent. The surface soil has a pH of about 5.1, a total exchange capacity of 17.2 m.eq. per 100 gm. of soil, a total exchangeable base content of 6.4 m.eq. per 100 gm. of soil, an organic-matter content of 4.1 percent, a bulk density of 1.18, and an available water-holding capacity of about 8.4 percent.

The land was plowed several times and Merker grass was planted in rows 4 feet apart with kudzu seeded between rows where required. The entire area was carefully managed until a uniform stand and a desirable species balance was attained.

The soil was limed to approximately pH 6.5. Two hundred pounds of phosphorus and 200 pounds of potassium were applied per acre yearly to all plots in the form of 20-percent superphosphate and potassium sulfate, respectively. Fifty pounds of nitrogen, in the form of ammonium sulfate, were applied to the Merker grass plots after each cutting. Since the forage was cut six times yearly, a total of 300 pounds of nitrogen were applied per acre yearly.

A split-plot design was used with Merker grass and the kudzu-Merker grass mixture as the main plots and the height-of-cutting variables—2 and 10 inches above ground level—as the subplots. Individual plots were 8 by 16 feet in size. All treatments were replicated six times.

The herbage in all plots was harvested about every 2 months, and all the forage was removed from the experimental area. No special effort was made to harvest the kudzu growing between the rows of Merker grass so that generally only that climbing the grass stalks was cut.

The dry weight of forage produced by each plot was determined, as was the proportion of kudzu and Merker grass. The crude-protein content of all samples was determined by standard methods.

A record of rainfall was kept during the entire course of the experiment.

RESULTS AND DISCUSSION

MERKER GRASS VS. A KUDZU-MERKER GRASS ASSOCIATION

The data in table 1 show that Merker grass growing alone and receiving nitrogen fertilization produced an average of 23,652 pounds of dry matter per acre yearly, or almost twice as much forage as did the kudzu-Merker grass association which yielded an average of only 12,232 pounds of dry

TABLE 1.—*The yield and protein content of Merker grass and of a kudzu-Merker grass mixture cut at two heights over a 2-year period on a Catalina clay soil at Orocovis*[1]

Forages and treatments	Dry-matter yield per acre per year	Protein	Protein yield per acre per year	Dry-matter yield per acre per year	Protein	Protein yield per acre per year	Dry-matter yield per acre per year	Protein	Protein yield per acre per year
	Pounds	*Percent*	*Pounds*	*Pounds*	*Percent*	*Lb.*	*Pounds*	*Percent*	*Pounds*
Merker grass[2]									
Cut at 2″ height...	25,170	7.3	1,842	—	—	—	—	—	—
Cut at 10″ height...	22,135	7.7	1,705	—	—	—	—	—	—
Average.....	23,652	7.5	1,773	—	—	—	—	—	—
Forages and treatments	***Total yields***			***Yields of Kudzu***			***Yields of Merker***		
Kudzu-Merker grass[3]									
Cut at 2″ height...	12,902	7.3	941	2,009	16.7	336	10,893	5.6	605
Cut at 10″ height...	11,562	8.6	989	2,521	17.0	428	9,041	6.2	561
Average.....	12,232	7.9	965	2,265	16.9	382	9,967	5.8	583

[1] All values are averages of 6 replications.

[2] Fertilized with 300 lb. of N per acre yearly applied in equal amounts after each harvest. Abundant Ca, K, and P were applied to all plots.

[3] All plots were fertilized with P, K, and lime.

matter per acre yearly. From the results cited previously it is likely that, had the Merker grass growing alone been more heavily fertilized with nitrogen, the differences in yield would have been even greater.

Since there was no significant difference in the protein content of the total forage produced in either case, the grass growing alone yielded almost twice as much protein per acre as did the grass-legume mixture. Merker grass itself, when grown alone, had a significantly higher protein content (7.5 percent as compared to 5.8 percent) than did that growing in association with tropical kudzu.

Although tropical kudzu contributed on the average only about 19 per-

cent of the dry matter produced by the mixture, it provided almost 40 percent of the protein because of the high protein content of this legume.

It is evident from the above that properly fertilized Merker grass cut for soilage can produce much more forage of as high a protein content as that of a kudzu-Merker grass association. This is an important consideration in such a heavily populated country as Puerto Rico, where maximum use must be made of the land. Furthermore, it is much easier to establish and to manage Merker grass growing alone.

Under grazing, however, the situation is different. Instead of removing from the field all the nitrogen contained in the forage, much of it is returned to the soil in the wasted or trampled herbage and in the excreta of the grazing animals, and is eventually available for use by the grass. Thus, under grazing, the difference in yield between Merker grass fertilized with nitrogen and a kudzu-Merker grass association would be expected to be considerably less. Research is now under way to evaluate Merker grass pastures heavily fertilized with nitrogen under grazing management.

THE EFFECT OF CUTTING HEIGHT

The data in table 1 show that Merker grass, both alone and in association with tropical kudzu, produced significantly higher yields when cut 2 inches from the ground than when cut at a 10-inch height. Tropical kudzu, on the other hand, produced significantly more forage when cut at a 10-inch height. Because of this opposite, and therefore compensating influence, height of cutting had no apparent effect on yields of the kudzu-Merker grass association.

The protein content of the forage produced by the mixture, however, was significantly higher with high cutting (8.6 percent as compared to 7.3 percent with low cutting) due to the higher proportion of kudzu present. Height of cutting had no apparent effect on the protein content of either the Merker grass or the tropical kudzu.

It thus seems best to cut Merker grass growing alone at a height of about 2 inches above the ground, whereas a kudzu-Merker grass mixture should be cut considerably higher.

SEASONAL DISTRIBUTION OF FORAGE PRODUCTION

Figure 1 shows the seasonal distribution of forage produced by Merker grass and a tropical kudzu-Merker grass association. In both cases forage production was very unevenly distributed throughout the year. The difference was more marked in the case of Merker grass growing alone, however. Both the grass and the grass-legume mixture produced about twice as much forage during the so called "summer" months (April to October) as during the "winter" months.

Daily per acre production of dry matter by Merker grass growing alone varied from a minimum of about 20 pounds, or enough to provide the forage requirements of one mature animal, to a maximum of about 120 pounds. In general, this grass produced enough forage to supply the needs of two animals per acre during the winter months and four during the summer. The kudzu-Merker grass association produced a minimum of 10 pounds of dry matter per acre daily and a maximum of about 45 pounds. In general, this mixture produced sufficient forage to feed an animal per acre during the winter and two animals during the summer.

The question naturally arises as to what factor or combination of factors

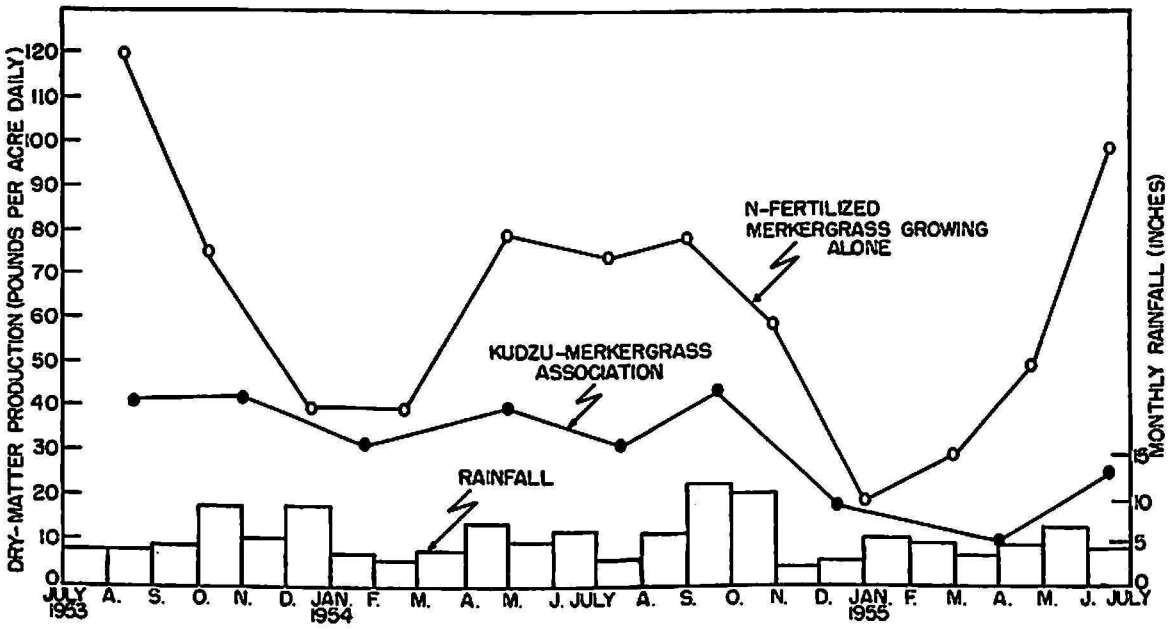

FIG. 1—The effect of season and rainfall on the productivity of Merker grass and of a Merker grass-kudzu association grown at Orocovis, P. R.

is responsible for the relatively low forage production during the winter months. The data shown in figure 1 indicate that rainfall was somewhat lower during the winter months. On the average, rainfall during the summer was about 6 inches monthly as compared to about 4.6 inches monthly during the winter.

A study of figure 1 shows that other factors apparently had a greater effect on forage production than did rainfall. Several examples can be used to illustrate this point. During the first year's peak period of growth, July–August, monthly rainfall averaged 4.5 inches as compared to 5.4 inches during the following minimum growth period of November–March 1954, when Merker grass produced only about a third as much forage. Similarly, rainfall alone could hardly have been responsible for the difference in forage production between the low of December–April 1955 (4.4

inches of rainfall monthly) and the periods of fast growth July–August 1953 (4.5 inches of rainfall monthly) and May–June 1955 (5.4 inches of rainfall monthly).

During the winter months the weather was somewhat cooler and the days considerably shorter than during the summer. Kudzu produces seed during the winter and Merker grass tends to flower at this time before attaining maximum development. It appears likely that the cooler weather and shorter days reduced vegetative growth and stimulated reproduction. These two factors seemed to exert a greater effect on yields than did rainfall. It is of interest to note that Vicente and Caro (3) found that Guinea grass produced much more forage during the summer than during the winter even though moisture was abundant.

The above raises a serious question as to the advisability of establishing supplemental irrigation systems for forages in the humid areas of Puerto Rico. This is sometimes done in an effort to equalize forage production throughout the year. An exception may be the sandy soils of the North Coast where moisture is limiting at different times of the year.

A more logical approach to the serious problem of uneven forage production throughout the year would probably be the use of silos to store the excess forage produced during the summer, the storage of herbage in the field through proper pasture management, and the use of forage crops which may grow more evenly throughout the year.

SUMMARY

The yields of a tropical kudzu-Merker grass association were compared to those of Merker grass growing alone and fertilized with 300 pounds of nitrogen per acre yearly. The effect of two heights of cutting and of season of the year on the productivity of these forages was also studied.

Merker grass produced 23,652 pounds of dry matter and 1,773 pounds of crude protein per acre yearly, or about twice as much dry matter and protein as did the kudzu-Merker grass association. Kudzu contributed about 19 percent of the dry matter and almost 40 percent of the protein produced by the association.

The Merker grass growing alone had a higher protein content than that growing with kudzu. Merker grass both alone and in association with kudzu yielded more when cut at a height of 2 inches from the ground than when cut at a 10-inch height. The reverse was true with tropical kudzu. Because of this compensating effect cutting height had no significant effect on yields of the kudzu-Merker grass mixture. Because of a higher proportion of kudzu, the protein content of the mixture was greater with high cutting, however.

Both Merker grass and the kudzu-Merker grass association yielded about

twice as much forage during the "summer" months as during the "winter" months. Lower rainfall, cooler temperature, and shorter days during the "winter" months appeared to be responsible for the reduction in growth occurring during this season. The latter two factors were apparently responsible for most of the difference in growth rates which suggest that only limited benefits may accrue from supplemental irrigation of forages during the "winter" months in the humid areas of Puerto Rico.

RESUMEN

Los rendimientos de una mezcla de kudzú tropical y yerba Merker fueron comparados con los de la yerba creciendo sola y abonada a razón de 300 libras de nitrógeno por cuerda por año. También se estudió el efecto de la estación del año y de dos alturas de corte en los rendimientos de estas forrajeras.

La yerba Merker produjo 23,652 libras de materia seca y 1,773 libras de proteina por cuerda por año. Esta cantidad resultó ser aproximadamente el doble de la producida por la mezcla de la yerba y la leguminosa. El kudzú tropical aportó alrededor del 19 por ciento de la materia seca y 40 por ciento de la proteina producidas por la mezcla.

La yerba Merker sola tuvo un contenido de proteina mayor que el de la yerba que creció en asociación con la leguminosa. La yerba sola o en asociación con la leguminosa produjo los más altos rendimientos cuando se cortó a 2 pulgadas del suelo. Por el contrario, el kudzú produjo rendimientos más altos cuando se cortó a 10 pulgadas de la superficie del suelo. Debido a este efecto compensativo no hubo diferencias significativas entre los rendimientos de la mezcla cortada a dos alturas. Sin embargo, el contenido de proteina en la mezcla cortada a 10 pulgadas resultó ser más alta que cuando se cortó a 2 pulgadas, debido a la mayor proporción de kudzú bajo este sistema de corte.

Tanto la yerba como la mezcla produjeron rendimientos mucho más altos durante los meses de verano que durante el invierno. Tal parece que la temperatura baja, los días cortos y la escasez de precipitación pluvial fueron los factores responsables de esta disminución en rendimientos.

Aparentemente los días cortos junto a temperaturas bajas fueron los factores predominantes en esta reducción, lo que hace pensar que el regadío suplementario no tendría gran efecto en el rendimiento de estos forrajes durante los meses de invierno en la región húmeda de Puerto Rico.

LITERATURE CITED

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