The Yield and Quality of Four Nitrogen - Phosphorus Fertilized Grasses

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Story in Brief

Three introduced grasses were established in plots and evaluated concurrently with native range grasses growing on the Reddish Prairies of Central Oklahoma. The experimental site, near Stillwater, Oklahoma, may be described as mixed-grass prairie on shallow, clay-loam soils. Nitrogen fertilizer was applied in two split-applications at levels of 0, 60, 120, and 200 lbs. Nitrogen per acre. Phosphorus levels applied in a single application were either 0 or 80 lbs. P_2O_5 per acre.

Dry matter yields and crude protein contents were increased in all grasses with addition of increasing levels of either nitrogen or phosphorus fertilizer. In general, neither nitrogen nor phosphorus fertilization brought about changes in forage digestibility. The different grass types were tremendously different in yields and quality. The data suggest that the potential exists for a 4 to 5 fold increase in the production of digestible nutrients, and a 3 fold increase in the production of protein, in the area studied and on similar depleted rangeland sites, with systems requiring a minimum of grassland management, and employing introduced grasses presently at hand.

Introduction

There are about six million acres of rangeland in the Reddish Prairie area of Central Oklahoma which because of a history of abuse and overgrazing have become unproductive. Several improved grass species are suggested for use in renovation of poor rangeland. Among those most often recommended are bermudagrass, weeping lovegrass, and the "Old World" bluestems, and while these grasses have been individually studied in depth there have been few or no tests designed to compare these forages to one and another and to the existing vegetation, under dry-land conditions. The objectives of this experiment were to

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compare these introduced grasses plus existing range vegetation for the following characteristics: (1) total dry matter production (2) seasonal distribution of dry matter production (3) effects of different levels of nitrogen and phosphorus fertilization (4) chemical composition and *in vitro* digestibility.

Materials and Methods

Small plots (30'x80') of the introduced grasses were established in the spring of 1970, in a native grass pasture on the Lake Carl Blackwell Range near Stillwater, Oklahoma. The native range grass stand was in poor condition. Grasses appearing in the native mixture included primarily little bluestem, sideoats grama, and hairy grama. Soil tests indicated that the clay-loam type soil was low in phosphorus and very low in nitrogen, but moderately high in organic matter.

Fertilizer treatments were superimposed on the plot layout beginning in the spring of 1971. Nitrogen was applied at levels of 0, 60, 120, or 240 lbs. Nitrogen per acre in two split applications; the first in early March at a rate of 80 lbs. per acre P_2O_5 to one half of the plots while half of the plots received no supplemental phosphorus. The treatments were arranged so that every fertilizer combination was represented on each grass type, in four plots.

Forage was harvested and weighed as sufficient material became available. This practice resulted in collection of three cuttings each from weeping lovegrass and bermudagrass plots, two cuttings from Plains Bluestem and one cutting from native grasses.

Samples from each plot were dried and ground for laboratory analysis. Crude Protein and ash were determined by procedures described in A.O.A.C. (1960). Digestibility was determined *in vitro* (in a test tube) using ruminal fluid from a Rumen-fistulated steer as described by Tilley and Terry (1963).

Results and Discussion

Effects of nitrogen and phosphorus fertilization upon forage yields are shown in Figures 1, 2, 3, and 4 for Midland bermudagrass, Plains bluestem, Morpa weeping lovegrass, and native range, respectively. Nitrogen fertilizer at increasing levels increased forage yields in all grass types, as witnessed by the slope of the lines. Phosphorus fertilization also increased forage yield of all grasses as indicated by the distance between the lines. The plots receiving both nitrogen and phosphorus fertilizers had the highest yields.

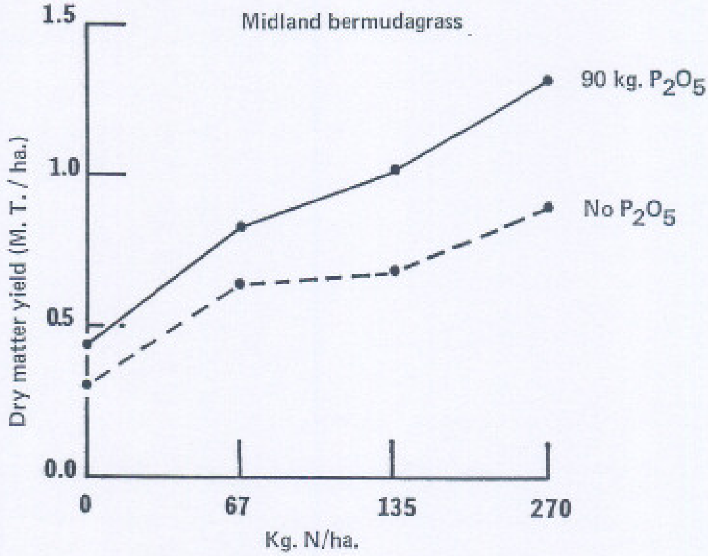

Figure 1. Dry matter yield of Midland bermudagrass at various levels of N and P fertilizer.

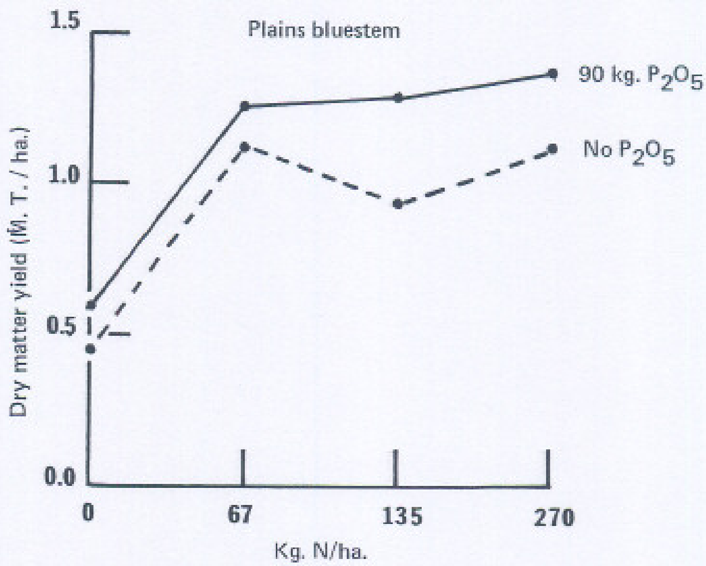

Figure 2. Dry matter yield of Plains bluestem at various levels of N and P fertilizer.

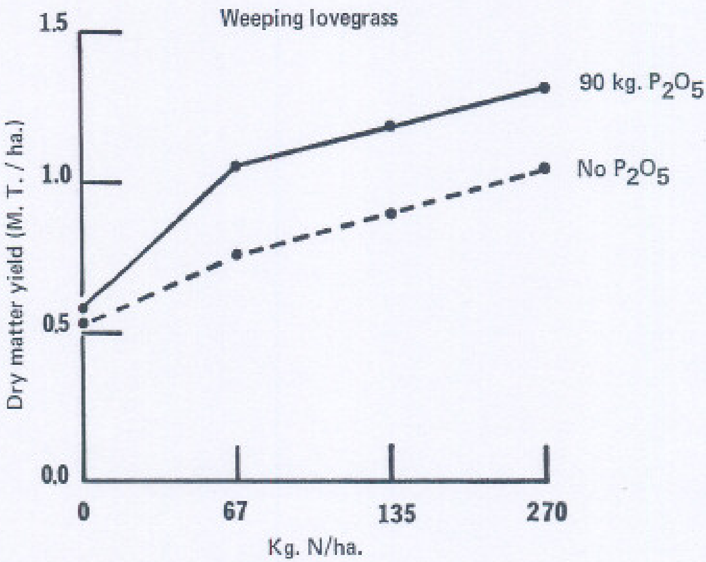

Figure 3. Dry matter yield of Morpa weeping lovegrass at various levels of N and P fertilizer.

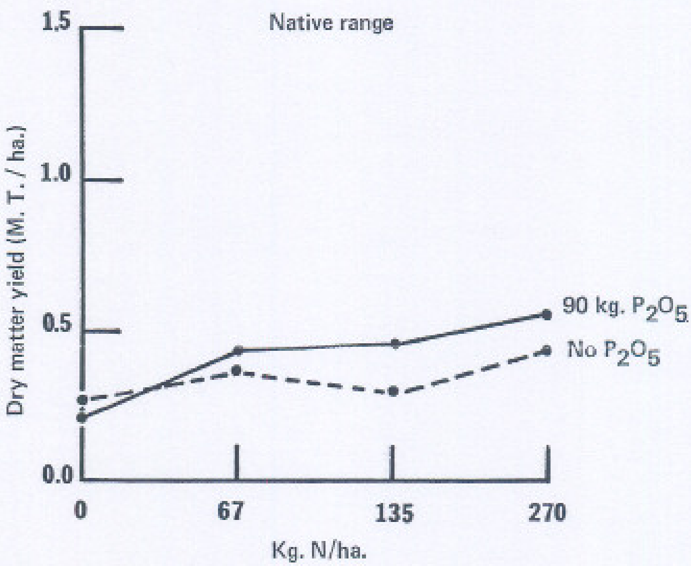

Figure 4. Dry matter yield of Native Range grasses at various levels of N and P fertilizer.

Plains bluestem showed the greatest response to fertilization and had the highest average yield (5.23 Tons/acre) of the grasses studied. Morpa weeping lovegrass yielded an average of 4.22 Tons/acre followed by Midland bermudagrass with 3.83 Tons/acre and the native range grasses with 1.62 Tons/acre. At this point it is well to mention that dry matter yield alone is not as important as *yield of digestible or available nutrients.*

Average digestibilities are presented in Figures 5, 6, 7, and 8 for Midland bermudagrass, Plains bluestem, Morpa weeping lovegrass, and native range, respectively. Nitrogen fertilization at increasing levels appeared to increase dry matter digestibility in Midland bermudagrass as indicated by the slope of the line, but there was no effect of nitrogen apparent in other forages. Phosphorus fertilization had no apparent effect on digestibility. Midland bermudagrass and Plains bluestem generally maintained highest digestibilities; Morpa weeping lovegrass was somewhat lower, and native grasses were at times, very low. Stage-of-maturity is the most important factor influencing digestibility of forages and it should be noted that most of the cuttings in all grasses were made when forage was in the full-head stage-of-maturity. One of the effects of nitrogen fertilizer in grasses which are responsive, is to keep the plant in a vegetative stage-of-growth longer. It is likely that this is how nitro-

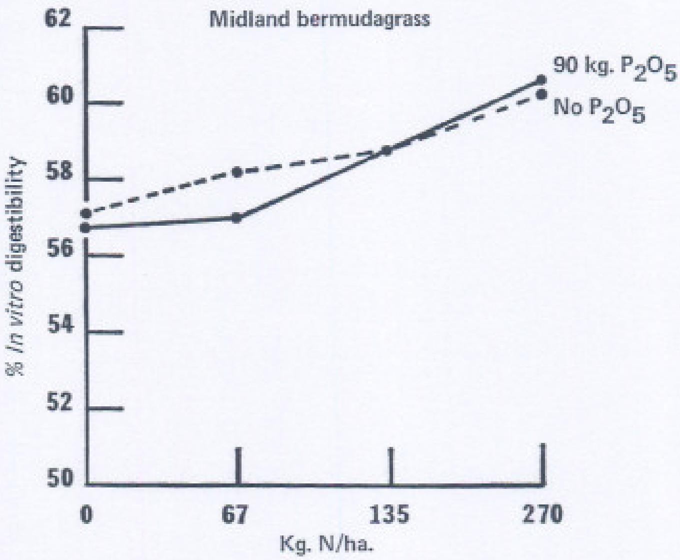

Figure 5. In vitro digestibility of Midland bermudagrass at various levels of N and P fertilizer.

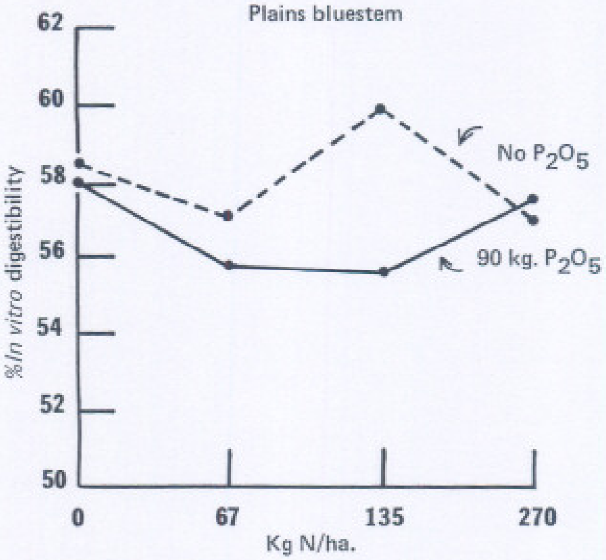

Figure 6. In vitro digestibility of Plains bluestem at various levels of N and P fertilizer.

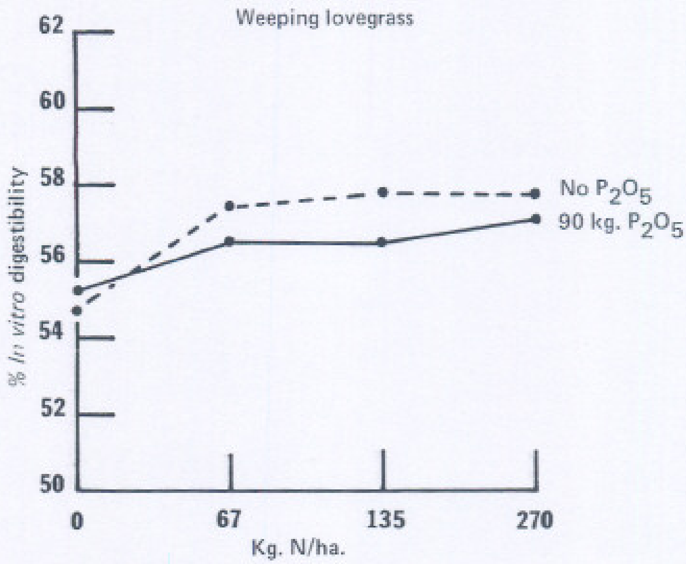

Figure 7. In vitro digestibility of Morpa weeping lovegrass at various levels of N and P fertilizer.

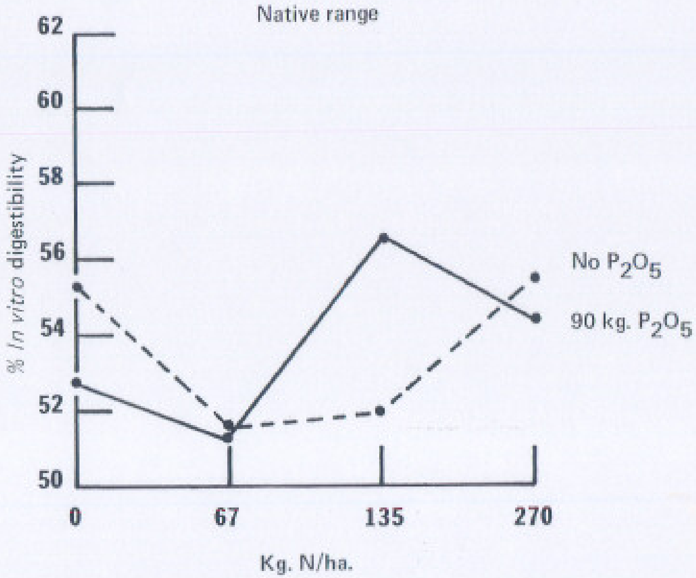

Figure 8. In vitro **digestibility of native range grasses at various levels of N and P fertilizer.**

gen fertilization brought about the improvement in digestibility of bermudagrass.

Another factor of great importance in cow-calf operations where pasture or range is a part of the management system, is protein content. The protein contents are presented in Figures 9, 10, 11, and 12 for Midland bermudagrass, Plains bluestem, Morpa weeping lovegrass and native grasses, respectively. Nitrogen fertilization at increasing levels brought about dramatic increases in protein contents. That phosphorus fertilization did not influence protein content in any of the grasses is indicated by negligible distances between the lines. It should be noted that increased yield of protein on native grass plots could have been due to the severe weed infestation which developed when high levels of nitrogen were applied.

Midland bermudagrass provided the highest level of protein as expected, followed by weeping lovegrass, Plains bluestem and native grasses respectively. It is important to note that the protein requirement of dry, pregnant mature cows is only 2.8 per cent of the dry matter, hence all of the grasses studied could provide at least marginal protein nutrition. Cows nursing calves, however, require protein in excess of 5.4 per cent of the diet. This means that even during the spring and summer grazing

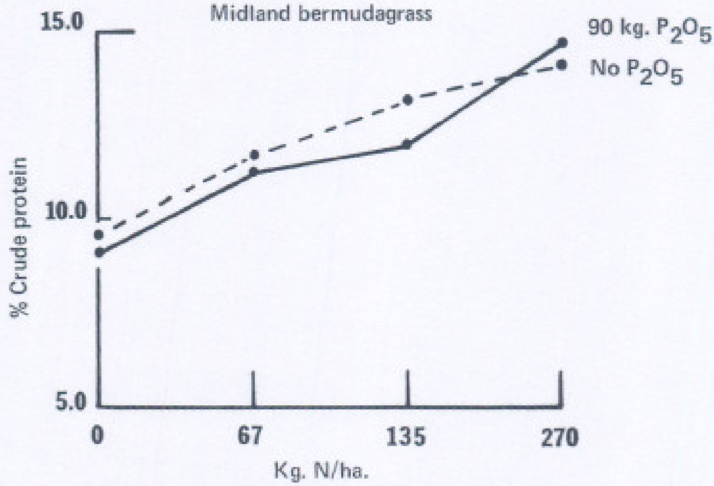

Figure 9. Crude Protein contents of Midland bermudagrass at various levels of N and P fertilizer.

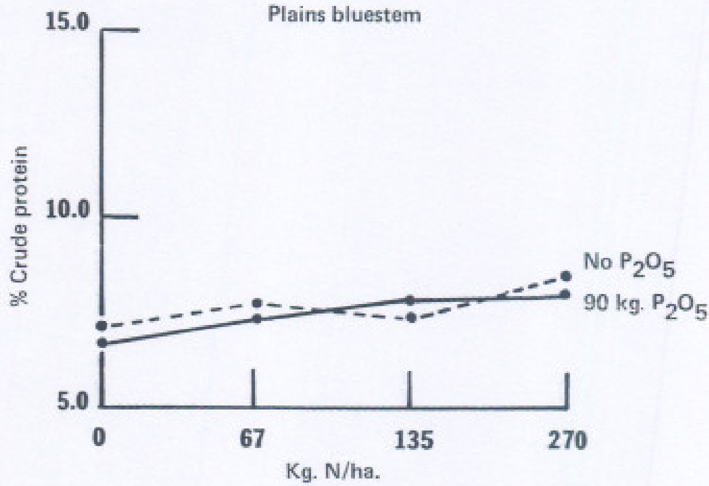

Figure 10. Crude Protein contents of Plains bluestem at various levels of N and P fertilizer

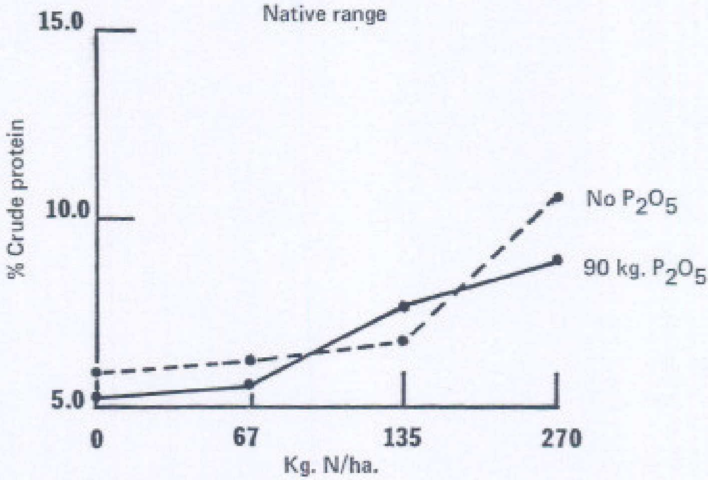

Figure 11. Crude Protein contents of Morpa weeping lovegrass at various levels of N and P fertilizer.

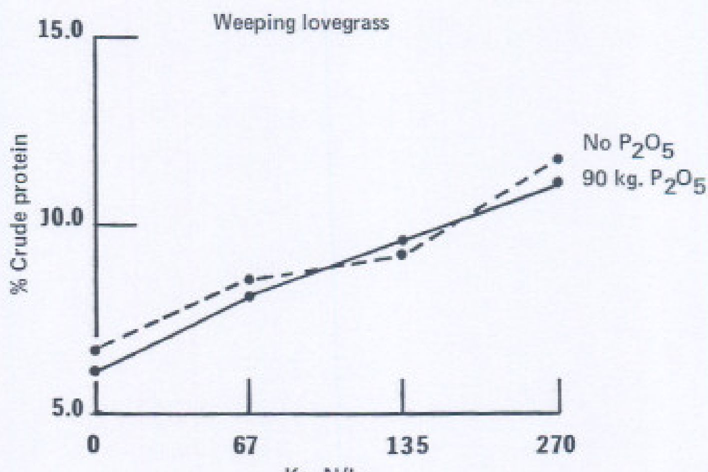

Figure 12. Crude Protein contents of native range grasses at various levels of N and P fertilizer.

season, cows grazing native grasses may be consuming a diet deficient in protein. In this respect, the introduced grasses demonstrated a marked advantage over the native grass mixture.

References

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Tilley, J.M.A. and R. A. Terry. 1963. A two-stage technique for the *in vitro* digestion of forage crops. J. Brit. Grassland Soc. 18:104.

A Preliminary Report of Performance to Weaning of Certain Two-Breed Cross Calves

T. A. Stanforth, R. R. Frahm and W. E. Sharp

Story in Brief

The purpose of this study was to present data concerning birth and weaning traits of two-breed cross calves produced by 363 Hereford and Angus cows that were bred to Simmental, Brown Swiss, Jersey, Hereford and Angus bulls. Results indicate that use of Simmental and Brown Swiss bulls can improve preweaning growth potential relative to Hereford, Angus and Jersey crosses. However, increased calving problems were encountered with Simmental and Brown Swiss crossbreds, especially when bulls of these breeds were used on first calf heifers. Jersey crosses in general were not comparable in growth performance to the other crossbreds. However, essentially no calving problems were encountered with Jersey crosses.

Considerable calving problems were encountered with first calf heifers bred to Simmental and Brown Swiss bulls. Less than half of the