DISTURBANCE BY MECHANICAL PHOSPHOROUS FERTILIZATION ON THE COVER AND BIOMASS OF HUMID ALKALINE COMMUNITIES OF THE FLOODING PAMPA (ARGENTINA).

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ABSTRACT
Experiments were carried out in order to evaluate the impact of mechanical perturbations, phosphorous fertilization and grazing on the native grasslands. Six treatments were tested: three without grazing and three subjected to grazing. Both situations were plowed, plowed plus fertilization or kept untreated. During the study botanical composition, vegetative cover, species diversity and above ground biomass were measured. Plowed and plowed plus fertilization treatments drastically reduce all of these parameters related to community structure and forage production. These figures contrasted with the non-perturbated treatments, were values did not change significantly from the original state. Mechanical perturbations provoked reductions on grassland biomass availability which was recovered in eight months. After two years, no beneficial effects were observed on the plowed and fertilized treatments for grazed and ungrazed systems. Furthermore, results suggest that farm practices including the phosphorus fertilization induced negatives changes in the succession process.

KEYWORDS
Native grasslands, phosphorous fertilization, alkaline communities, grazing

INTRODUCTION
The main use of the grasslands in the Flooding Pampa is the cattle raising. Despite this, there exists a high proportion of halomorphic communities with low forage availability. Annual mean precipitation is 950 mm and mean monthly temperatures range from 6 °C in winter to 22 °C in summer. Flat topography, along with low hydraulic conductivity in the B horizon, determine the occurrence of both flooding events and droughts. Despite these constraints and because of mild weather conditions, phenology and biomass dynamics did not show a well-defined growing season (Sala et al., 1981; Ansín, 1995).

The addition of phosphorous, a deficient nutrient of soils in the region, increases the grassland aerial biomass and modifies its botanical composition favorably (Cauhépé et al., 1976; Mendoza et al., 1983). Our hypothesis is that independently of the grazing, plowing of the soil, in order to incorporate phosphorus, will damage the structure and will disturb the functionality of the grassland hence reducing forage availability.

The objective was to determine variations in the plant cover, botanical composition, species diversity and forage availability derived from the mechanical disturbance, phosphorous fertilization and grazing.

MATERIAL AND METHODS
The experiment was conducted, from 1987 to 1989, on a humid alkaline community which included *Paspalum vaginatum* (Sw.), *P. dilatatum* (Poir.), *Distichlis scoparia* (Kunth), *D. spicata* (L.), *Scirpus olneyi* (A. Gray), *Lotus tenuis* (Waldst. et Kit) and *Melilotus indicus* (L). The soil is Natracualf albico and the treatments were: three under grazing and three ungrazed treatments. Both situations were plowed, plowed and fertilized or untreated. Each treatment, with two repetitions of 2,500 m^2, was placed at random. The experiments were repeated in two plots with the same structure.

The plowing and fertilization were done with a disc plough with a fertilizer spreader behind, incorporating in this way 200 $kg.ha^{-1}$ of diamonic phosphate (92 kg P_2O_5).

The botanical composition was determined seasonally by the Braun-Blanquet method (Ansín and Oyhamburu, 1993) on areas of 25 m^2 taking three samples in each treatment. The species diversity was calculated using the Shannon-Weaver index, making use of the data from the botanical census.

Grazing, 0.68 $cow.ha^{-1}.year^{-1}$, was carried out with Aberdeen Angus cows in summer, autumn and spring. Before placing animals on the plots, total and compartmental dry matter (DM) availability were measured. Plants were cut down to ground level, in rectangles of 0.5 m^2 with the same number of repetitions and locations, cut plants were separated into: gramineous, legumes, wide leaf herbs and ground litter. Separated plant material was dried to a constant weight.

Soil phosphorous availability was measured, with a modified Bray-Kurtz method (ascorbic acid), at the beginning of the study and in autumn of 1989.

Results were analyzed using the ANOVA. Mean comparison were conduced when $P<0.05$.

RESULTS AND DISCUSSION
Initially the soil showed deficiencies of phosphorous (5 ppm) and a low population of legumes was observed. The plowed treatments, including phosphorous fertilization, reduced ($P<0.05$) the plant cover from 83% to 50% in the winter of 1987.

Opposite to the report by Ginzo et al. (1982), the number of species decreased ($P<0.05$) from 23 to 6 in the plowed and 5 in the plowed and fertilized treatments.

In agreement to Ansín (1995) the impact of an exogenous factor over the structure and the functioning of the Pampean grassland is shown by it's species diversity. So in figure 1 it may observe the effects of the plowed in the humid-alkaline communities.

Except for the untreated area, all the other treatments presented reductions ($P<0.05$) in the total DM availability. In the plowed plots, it was reduced from the initial 2,800 to 1,000 $kg.ha^{-1}$. It was not till autumn of 1988 that DM equaled the one reached by the control.

After this and possibly associated with animal consumption, the treatments under grazing presented variations ($P<0.05$) in their availability: 2,640; 1,940 and 2,200 $kg.ha^{-1}$ in respect to the non grazed areas: 4,530; 4,400 and 4,000 $kg.ha^{-1}$ of DM. Values in the non treated plot agreed with the report by Mendoza et al. (1983), but they did not present an increase ($p>0.05$), as a consequence of fertilization, relative to the initial values.

Phosphorous incorporation did not increase the legumes DM

availability. This was because the presence of *L. tenuis* and *M. indicus*, never exceeded 1% of the soil cover. This contrasts with Cauhépé et al. (1976), who obtained an increase in the biomass on fertilized grassland.

Although the final trend of cover and forage availability were similar to initial date, did not coincide with the forage value because of its poor botanical richness. The functionality of the grassland was dramatically affected by the treatments; this was noticed in the species diversity decrease of the plowed and fertilized plots.

The increase in the grasslands productivity with phosphorous fertilization, as suggested by previous research, was not shown in this test. This may be related to the disturbing effect caused by the plowing, that would have stopped a favorable result coming up from the phosphorous application.

CONCLUSIONS

The perturbations caused by the plowing reduced the soil cover and the forage biomass availability. Although these parameters were recuperated within eight months, we could not observe the same in the species diversity of the grassland.

After two years the botanical succession of the plowed and fertilized treatments showed a reduction in the functionality of the pastoral system.

REFERENCES

Ansín, O.E. y E.M. Oyhamburu. 1993. Cobertura vegetal y composición florística: comparación de los métodos visual y puntual para estimar la estructura de un pastizal natural. Revista Argentina de Producción Animal **13**: 91-96.

Ansín, O.E.. 1995. Pastoreo de comunidades halomórficas de la Pampa Deprimida. M Sc Tesis, Escuela para Graduados. Facultad de Agronomía UBA. Argentina.

Cauhépé M.A., E. Ridruejo y O. Aldea. 1976. Intersiembra y fertilización en cobertura, como métodos alternativos de modificación de los pastizales de la Depresión del Salado. Revista Argentina de Producción Animal **2(6)**: 510-515.

Ginzo, H.D., M.B. Collantes and O.H. Caso. 1982. Fertilization of a native grassland in the "Depresión del Río Salado", province of Buenos Aires. Herbage dry matter accumulation and Botanical composition. Journal of Range Management **1 (35)**: 35-39.

Mendoza R.E., D.H. Cagliatti, M.B. Collantes y M. Kade. 1983. Efecto de la fertilización nitrógeno-fosfatada sobre el crecimiento otoño-invernal y la absorción de fósforo en tepes de un pastizal natural. Turrialba **33**, **(3)**: 311-320.

Sala, O.E., V.A. Deregibus, T.M. Schlichter and H.A. Alippe. 1981. Productivity dynamics of a native temperate grassland in Argentina. Journal of Range Management **34**: 48-51.

Figure 1

Species diversity (values followed by different letter (capital in the same treatment between climatic station and small within treatments in the same climatic station) are significantly different P<0.05).