Crude protein content in *Urochloa* cultivars (Syn. Brachiaria) in exclusive pasture system or consorciated with *Macrotyloma axillare* cv. Guatá

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Abstract

The objective of this study was to evaluate the crude protein content of *Urochloa* spp. cultivars (*U. brizantha* cv Marandu and *U. decunbens* cv. Basilisk), within a consortium system with *Macrotyloma axillare* cv Guatá. The experimental design was a completely randomized design, with four replications, in a factorial scheme (2 x 2), at which two types of grass (*U. decumbens* and *U. brizantha*) and two pasture types were studied (intercropped or exclusively fertilized with 60 kg of nitrogen/ha) with repeated measures in time (samplings at two seasons of the year: February (summer) and August (winter)). Subsequently, samples were collected from a 2 m long PVC bar at four points in each picket, and the forage cut close to the ground, with costal mowing coupled with 0.5 m length hedge trimmer, each sample of 0.5 x 2.0 m, totalizing 1m^2. The sampled material was identified, weighed and sent for analysis of crude protein to assess the contribution of leguminous in grass protein content. No significant differences were found when the type of grass versus type of pasture interaction for the crude protein variable was met; however, significant differences were found when evaluating the type of grass versus season interaction, at which the highest levels were found within the month of February (summer), the same occurring for the interaction type of pasture versus season of the year. It was concluded there were increases in crude protein content for *U. decumbens* cv. Basilisk and *U. brizantha* cv. Marandu when in consortium with *M. axillare* cv. Guatá in the summer season.

Keywords: Biological nitrogen. Forage. Forage quality. Leguminous.

Introduction

Brazilian livestock has made significant progress in recent decades, and Brazil has reached the position of being one of the largest producers and bovine meat exporters; according to the Yearbook DBO (2017), the Brazilian cattle herd, with approximately 215 million heads, raised predominantly in pasture is the second largest in the world.

An important issue in forage production is the variation in forage availability throughout the year, known as seasonality of production, at which the production of fodder in the rainy season and

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in the dry season is obtained with little or no supply. However, there is a great supply of forage, but of inferior quality (SILVA; SALIBA, 2007; CARVALHO; PIRES, 2008).

Forage production in tropical soils usually occurs in soils with high weathering characteristics, low natural fertility and high phosphorus fixing capacity and, according to Paulino et al. (2008), in order to make them sustainable, anthropic interference with the input of external inputs is required, which consists of providing the necessary nutrients to the plants, in recommended quantity and quality, in periods of better use or need of the plants.

Nitrogen (N), widely used in pasture maintenance due to its determinant character of production, provides forage dry mass maximization and, consequently, higher stocking and meat production per hectare (WERNER et al., 2001), besides being an essential constituent of proteins that interferes directly in the photosynthetic process through its participation in the chlorophyll molecule; therefore, it is one of the main nutrients for the intensification of pasture productivity, and in its absence or frequent availability, pasture production will suffer reduction, initiating the degradation process (MEIRELLES, 1993).

The great difficulty arises from the fact that N is a highly reactive element, being subject to several transformations in soil and plants (MOREIRA; SIQUEIRA, 2006).

In an attempt to minimize production costs and environmental impacts from the use of nitrogen fertilizers, an ecologically correct and sustainable alternative is the use of a consortium between leguminous and grasses within the production system, at which leguminous fix nitrogen and end up acting as sources of this nutrient to the grasses (WERNER et al., 2001).

Carvalho and Pires (2008) say, in a pasture system, the most limiting nutrients are phosphorus and nitrogen; applications with nitrogen sources in pasture minimize quantitative and qualitative problems in pasture production since nitrogen can be introduced into the system by two ways: introduction of forage leguminous that are intercropped with pasture or with the application of mineral nitrogen.

The use of nitrogen from nitrogen fertilizers, as a rule, is a costly practice, and the use of leguminous in tropical pastures becomes an efficient and inexpensive strategy for the introduction of nitrogen to the system.

According to Paulino et al. (2008), the 70s and 80s marked Brazil, as it was the period for the greatest number of researches involving the consortium system, with emphasis on the genera Stylosanthes, Glycine Galactia, Macrotyloma and Calopogônio; however, at that time, most of the experiments were carried out in greenhouses, with leguminous being established in exclusive cultivation; when they were directed to intercropping, the focus was predominantly between plants that had compatibility among the species involved.

Therefore, the purpose of this study was to quantify Crude Protein (CP) value for cultivars of *Urochloa* spp. (*U. brizantha* cv. Marandu and *U. decunbens* cv. Basilisk), under exclusive pasture or with a consortium system with *Macrotyloma axillare* cv. Guatá, in two seasons of the year (summer and winter).

Material and methods

The experiment was conducted at the Regional Center for the Technological Development of Agribusiness in the Center-West - APTA-SAA, at the Research Unit of Brotas (SP). The city of Brotas is located at 22° 16' South Latitude and 48° 70' West Longitude, with an altitude of 650 meters, and subtropical climate Cwa (hot and rainy summer and dry winter), according to Koppen classification. The material of the study of this paper were *U. brizantha* cv. Marandu and *U. decunbens* cv. Basilisk, used to about 20 years in other research projects.

The soil of the experimental area was classified as dystrophic Quartzeneic Neosol (EMBRAPA, 1999), containing an average of 9 % of clay, 33 % of fine sand, 57 % of coarse sand and 1 % of silt.

The experimental design was a completely randomized design, with four replications, in a factorial scheme (2 x 2), at which two grasses (*U. decumbens* and *U. brizantha*) and two pasture types were studied (intercropped or exclusively fertilized with 60 kg of nitrogen/ha) with repeated measures in time (samplings at two seasons of the year: February (summer) and August (winter)).

Both pastures were managed with forage canopy height around 30 cm, in a continuous stocking system with variable stocking rate (put and take).

The choice of animals to be placed in the area, altogether 45, was based on the similarity of weight, age and racial pattern. Therefore, the grazing was performed with freshly weaned male cattle Nelore, initial weight and age of about 150 kg and 12 months, respectively.

For both pastures, maintenance fertilization was applied according to Boletim 100 (RAIJ et al., 1997).

A mixture of 300 kg/ha of ammonium sulphate and 100 kg/ha of potassium chloride was applied to the haul in exclusive pasture treatments.

Sampling was carried out for each season by randomly launching a 2 m long PVC bar at four points of each picket, at which the forage was cut close to the ground, with a costal clipper coupled with a fence pruner, 0.5 m long, each sample of 0.5 x 2.0 m, totalizing 1m^2 sampled.

The sampled material was separated into components leguminous, grasses and dead material, weighed, identified and sent for determining crude protein content (CP) according to A.O.A.C (1980).

Data were analyzed using the MIXED procedure of SAS (Statistical Analysis System), SAS Institute (2010), in order to determine the structure of variance and covariance matrix. The significance level for the analysis of variance was 5 %.

Results and discussion

It can be observed that, when evaluated the type of grass within the consortium or exclusive system, no significant differences were found in relation to crude protein content (TABLE 1).

Table 1. Crude protein (CP) in forages U. decumbens cv. Basilisk and U. brizantha cv. Marandu according to the type of pasture and season of the year.

	Crude Protein Content		
	Forage type		
Grazzing type	*U.decumbens*	*U. brizantha*	Means
Consortium	7,19±0,41aA	8,35±0,41aA	7,77±0,29A
Exclusive	6,64±0,41aA	6,23±0,41aA	6,43±0,29A
Means	6,92±0,29a	7,29±0,29a	
	Forage Type		
Season type	*U.decumbens*	*U. brizantha*	Means
February	9,56±0,43aA	10,68±0,43aA	10,12±0,30A
August	4,27±0,43aB	3,90±0,43aB	4,09±0,30B
Means	6,92±0,29a	7,29±0,29a	

Season Type	Grazzing Type Consortium	Exclusive	Means
February	11,65±0,43aA	8,59±0,43bA	10,12±0,30A
August	3,90±0,43aB	4,28±0,43aB	4,09±0,30B
Means	7,77±0,29a	6,43±0,29a	

Means followed by different capital letters in the columns and different lowercase letters in the lines differ from each other by the Tukey-Kramer test ($P < 0.05$)[1] statistic referring to transformed data for Log of (X+1)

Source: Prepared by the author (2018).

This insignificant result when evaluating the type of grass in relation to pasture type can be considered positive, since fertilization with 300 kg/ha of ammonium sulphate and 100 kg/ha of chloride of potassium was carried out for exclusive pasture, which did not occur for the types of intercropped grass.

The contribution of nitrogen by the leguminous to other crops in a consortium depends on the legume forage species, its mobilization potential and the efficiency for the production of phytomass. Therefore, the assimilation of nitrogen is determined by genetic material and environmental conditions and it can be enhanced by waste management (RAO; MATHUVA, 2000).

In this context, with the entry of leguminous plants, it is possible to obtain expressive and low cost results, since the adoption of a consortium can promote improvement in the pasture system through biological nitrogen fixation, increase of organic matter in the system and retention of carbon in soil, and it can also generate savings in fertilizer use.

Carvalho (1986), cited by Paulino et al. (2008), shows the contribution of leguminous to the leguminous/grass mix corresponds to nitrogen applications in the exclusive grass, ranging from 100 to 250 kg ha/year; under grazing conditions, most of the transfer takes place through mineralization of the nitrogen present in the leguminous residue and in the excrement of grazing animals.

Significant differences were observed when evaluating the interaction between grass and season of the year, and the highest levels were found in February (summer), according to Table 1. It is also observed the consortium system presented higher protein content during the month of February.

It can be observed that, when studying the type of grass in relation to season, the highest levels were found in the months of February, the same occurred when studying the type of pasture in relation to season.

Van Soest (1991) states CP levels, among other reasons, are influenced by the age of the plant, because the more it advances in its maturation stage, the lower is the CP concentration.

Euclides et al. (1996) reported higher percentages of CP, both in the leaves and in the stems, of Marandu grass and Tanzania grass in the rain season. According to Costa (1995), the best cutting age of Marandu grass, in order to reconcile the best yield and better CP contents, prevails between 56 and 70 days of vegetative growth.

Neves et al. (1980), working with cultivars of Brachiaria, obtained average values of CP of 10.9 and 6.17 % for cuts at 30 and 60 days, respectively, after standardization. When evaluating the interaction type of pasture versus season, one can observe significant statistical differences.

The highest values of CP (%) were observed in the month of February, when it is also possible to verify the intercropped pasture obtained a higher value. This increase, when analyzed together with

the information presented in the interaction between grass type versus season of the year, indicates the addition of the leguminous increased the quality of the pasture as a function of the CP content.

Almeida et al. (2002), which evaluated the effect of the season on nutritional values of Marandu grass, found maximum CP levels in the rainy season (9.7 %) in relation to the dry season of the year (8.9 %).

Gerdes et al. (2000), working with Brachiaria brizantha cv. Marandu (U. brizantha cv. Marandu), measured different values between the seasons following autumn, winter, spring and summer, with average values of 18.6, 13.7, 12.8 and 11.4% CP in DM, higher values than those of the present study even though the authors obtained forage with 35 days of regrowth in a single cut per season.

Conclusion

According to the results, it can be concluded that there were increases in crude protein content in forages of *U. decunbens* cv. Basilisk and *U. brizantha* cv Marandu, in a consortium system with *Macrotyloma axillare* cv. Guatá, in the month of February, that is, in the summer season.

Teor de proteína bruta em cultivares de *Urochloa* em sistema de pastagem exclusiva ou consorciadas com *Macrotyloma axillare* cv. Guatá

Resumo

Objetivou-se com este trabalho avaliar o teor de proteína bruta de cultivares de *Urochloa* spp. (*U. brizantha* cv. Marandu e *U. decunbens* cv. Basilisk) dentro de um sistema de consórcio com *Macrotyloma axillare* cv. Guatá. O delineamento experimental utilizado foi o inteiramente casualizado, com quatro repetições, em esquema fatorial (2 x 2), em que foram estudados dois capins (*U. decumbens* e *U. brizantha*) e dois tipos de pastagens (consorciadas ou exclusivas adubadas com 60 kg de nitrogênio/ha), com medidas repetidas no tempo (amostragens em duas épocas do ano: fevereiro (verão) e agosto (inverno)). Posteriormente, amostras foram coletadas de um cano de PVC com 2 m de comprimento em quatro pontos de cada piquete, e a forragem cortada rente ao solo, com roçadeira costal acoplada com podador de cerca-viva de 0,5 m de comprimento, correspondendo a 0,5 x 2,0 m (1m^2 amostrado) para cada amostra. O material amostrado foi identificado, pesado e enviado para análise do teor de proteína bruta para avaliar a contribuição da leguminosa nos teores de proteína do capim. Não foram encontradas diferenças significativas quanto à interação tipo de capim *vs*. tipo de pasto para a variável proteína bruta, porém foram encontradas diferenças significativas quando avaliada a interação tipo de capim *vs*. época do ano, os maiores teores foram encontrados dentro do mês de fevereiro (verão), o que também ocorreu para a interação tipo de capim *vs*. época do ano. Concluiu-se que houve incrementos no teor de proteína bruta na *U. decumbens* cv. Basilisk *e na U. brizantha cv.* Marandu quando em consórcio com o *M. axillare* cv. Guatá no período do verão.
Palavras-chave: Forrageira. Leguminosa. Nitrogênio biológico. Qualidade de forragem.

References

ALMEIDA, R. G.; NASCIMENTO JUNIOR, D.; EUCLIDES, V. P. B. Produção animal em pastos consorciados sob três taxas de lotação, no Cerrado. **Revista Brasileira de Zootecnia**, v. 31, n. 2, p. 852-857, 2002. Disponível em: http://www.scielo.br/pdf/rbz/v31n2s0/21273.pdf . Acesso em: 16 ago. 2018.

ABIEC – ASSOCIAÇÃO BRASILEIRA DAS INDÚSTRIAS EXPORTADORAS DE CARNES. **Perfil da Pecuária no Brasil:** Relatório Anual. p. 20-29, 2018. Disponível em: http://abiec.siteoficial.ws/images/upload/sumario-pt-010217.pdf. Acesso em: 23 jul. 2019

ANUÁRIO DBO 2017: os números da pecuária. v. 35, n. 435, p. 14, 2017. Disponível em: https://issuu.com/portaldbo/docs/dbo_ed_435. Acesso em: 20 ago. 2018.

ASSOCIATION OF OFFICIAL ANALYTIVAL CHEMISTIS (AOAC)**. Official Methods of Analysis**. Washington, DC, p. 14-18, 1980. Disponível em: https://archive.org/details/gov.law.aoac.methods.1980/page/n35 . Acesso em: 16 ago. 2018.

CARVALHO, G. G. P.; PIRES, A. J. V. Leguminosas tropicais herbáceas em associação com pastagens. **Archivos de Zootecnia**, v. 57, p. 103-113. 2008. Disponível em: <http://www.uco.es/organiza/servicios/publica/az/php/img/web/25_12_52_894UsoCarvalho.pdf>. Acesso em: 20 ago. 2018.

COSTA, N. L. Curva de crescimento e composição química de *Brachiaria brizantha* cv. Marandu em Rondônia. In: REUNIÃO ANUAL DA SOCIEDADE BRASILEIRA DE ZOOTECNIA, 32., Brasília, 1995. **Anais**.... Brasília: SBZ, 1995. v. 1, p. 38-40.

EMPRESA BRASILEIRA DE PESQUISA AGROPECUÁRIA (EMBRAPA). Centro Nacional e Pesquisa de Solos. **Sistema brasileiro de classificação de solos.** Brasília, 2006. p. 184. Disponível em: https://www.agrolink.com.br/downloads/sistema-brasileiro-de-classificacao-dos-solos2006.pdf . Acesso em: 22 ago. 2018.

EUCLIDES, V. P. B.; MACEDO, M. C. M.; ZIMMER. A. H.; OLIVEIRA, M. P. Valores nutritivos de cinco gramíneas sob pastejo. In: REUNIAO ANUAL DA SOCIEDADE BRASILEIRA DE ZOOTECNIA, 33. 1996, Fortaleza. **Anais ...** Fortaleza: SBZ, 1996. v. 2, p. 90-92.

GERDES, L.; WERNER, J. C.; COLOZZA, M. T.; CARVALHO, D. D.; SCHAMMASS, E. A. Avaliação de características agronômicas e morfológicas das gramíneas forrageiras Marandu, Setária e Tanzânia aos 35 dias de crescimento nas estações do ano. **Revista Brasileira de Zootecnia**, v. 29, n. 4, p. 947-954, 2000. Disponível em: http://www.scielo.br/pdf/rbz/v29n4/5605.pdf. Acesso em: 25 ago. 2018.

MEIRELLES, N. M. F. Degradação de pastagens: critérios de avaliação. In: PAULINO, V. T.; ALCÂNTARA, P. B.; BEISMAN, D. A.; ALCÂNTARA, V. B. G. (Eds.). ENCONTRO SOBRE RECUPERAÇÃO DE PASTAGENS, 1., Nova Odessa (SP), 1993. **Anais...** Nova Odessa (SP): IZ, 1993. p. 27-48.

MOREIRA, F. M. S.; SIQUEIRA, J. O. Transformações bioquímicas e ciclo dos elementos no solo. **MICROBIOLOGIA E BIOQUÍMICA DO SOLO.** Lavras: UFLA, 2006, p.313-404. Disponível em: http://www.esalq.usp.br/departamentos/lso/arquivos_aula/LSO_400%20Livro%20-%20Microbiologia%20e%20bioquimica%20do%20solo.pdf . Acesso em: 20 ago. 2018.

NEVES, M. P. H.; KASS, M. L.; SERRÃO, E. A. S. Introdução e avaliação preliminar de gramíneas do gênero *Brachiaria* na região de Belém, Pará. In: CONGRESSO BRASILEIRO DE ZOOTECNIA, 1., 1980, Fortaleza. **Anais...** Fortaleza: UFC, 1980. p. 406-407.

PAULINO, V. P.; LUCENA, M. A. C.; GERDES, L.; COLAZZA, M. T.; BRAGA, G. J. Sustentabilidade de pastagens consorciadas. In: ENCONTRO TÉCNICO SOBRE LEGUMINOSAS FORRAGEIRAS - DESAFIOS E PERSPECTIVAS. 2., 2008, Nova Odessa. **Anais...** Instituto de Zootecnia, Nova Odessa (SP). Nova Odessa: IZ/APTA/SAA, 2008, p. 1-55. (CD ROOM).

RAIJ, B. V.; CANTARELLA, H.; QUAGGIO, J. A.; FURLANI, A. M. C. (Eds.). **Recomendação de adubação e calagem para o Estado de São Paulo**. 2. ed. Instituto Agronômico de Campinas: IAC Campinas, 1997. 285p. (Boletim Técnico, 100).

RAO, M. B.; MATHUVA, M. N. Legumes for improving maize yield and income in semiarid Kenya. **Agriculture Ecosystems and Environment**, v. 78, p.123-137, 2000.

SAS INSTITUTE. **Statistical analysis system:** user's guide: statistics. Cary, NC, 2010.

SILVA, J. J.; SALIBA, E. O. S. Pastagens consorciadas: uma alternativa para sistemas extensivos e orgânicos. **Veterinária e Zootecnia**, v. 14, n. 1, p. 8-18, 2007.

WERNER, J. C.; COLOZZA, M. T.; MONTEIRO, F. A. Adubação de pastagens. In: SIMPÓSIO SOBRE MANEJO DE PASTAGEM, 18., 2001, Piracicaba. **Anais....** Piracicaba: FEALQ, 2001. v. 1, p. 129-156.

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