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NUTRITIONAL SENSITIVITY PER MORPHOLOGICAL COMPONENT IN *Urochloa* HYBRID UNDER TROPICAL ENVIRONMENTS

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ABSTRACT

Camello® (GP 3025) is a tolerant to drought *Urochloa* hybrid grass showing good forage production, early flowering with high regrowth rates. The objective was to define nutrient concentration changes by morphological component and, their differences for two tropical contrasting environments. Nutrient concentrations differences ($P \leq 0.05$) were observed among morphological components over time. In environments (Aw_1) the morphological components showed higher average protein content in comparison to that from hostile conditions (Aw_0); lamina (12.2% *vs* 10.4%), pseudostem (9.5% *vs* 6.6%) and sheath (9.8% *vs* 6.8%). Hostile environments (Aw_0) promoted increases for FAD (47.9%, 46.9%, pseudostem and sheath, respectively) and lignin (6.6%, 9.1% pseudostem and sheath, respectively). The nutritional changes per morphological components is the best tool to define optimal moment for harvesting on nutritional bioavailability for livestock production intensification.

Key words*:* *Urochloa*-Camello, GP 3025, nutrient concentration dynamic's

INTRODUCTION

Tropical regions in Mexico cover a total of 56 million has, classified both as dry tropics (24 million ha) and humid tropics (32 million ha; SIAP 2017), with specific regimes of temperature and precipitation influencing plant growth and seasonal changes in nutritional value to time scale (Bernays and Chapman, 1994), being genotype x environment interaction the most important for forage nutritive variations, with both characteristics favouring high lignification rates promoted by the environmental and plant hormonal factors, inducing high senescence and remobilization of endogenous nutrients (Kwon and Park, 2008), leading to rapid decline in nutritional value of pastures, affecting quality in the dry tropics, promoting a strong nutritional loss in all plant's morphological components (Bernal-Flores *et al*., 2018). In order to understand the process and promote a livestock intensification production within tropical areas, it is necessary to carry out detailed studies among morphological components for nutrient concentrations and to establish key moments for forages use, to achieve the highest bioavailability of nutrients under vulnerable tropical environments. The study was carried out for a drought tolerant *Urochloa* hybrid; Camello® (Syn. GP 3025) to determine nutrients concentrations dynamics by morphological component for tropical environments.

METHODS AND MATERIALS

The study was conducted simultaneously in two locations with environmentally different conditions; Ocozocoautla, Chiapas (Aw_1) and Puerto Escondido Oaxaca (Aw_0), give more details about the two sites including temperature, precipitation etc on established *Urochloa* hybrid (GP 3025; Camello®) pasture. The pasture in both places, received same management; fertilization doses (100-00-00), frequency cut (7, 21,49 days) and cutting height (10 cm above soil level). The evaluation was carried out during 2017's rainy season and samples for analysis, were collected four different days after cutting. Two samples were analyzed for crude protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF) and, lignin using Near Infrared Spectroscopy (NIRS). After manual harvesting samples were dried using an air forced oven at 55ºC for 48h. Forage samples were fractionated into components: lamina, pseudostem and sheath at different regrowth periods(7, 21, 35 and 49 days) and a seasonal growth curve was obtained.

Statistical Analysis

Data were analyzed using two linear mixed models; specific model (analysis between morphological components corresponding the same place) and general model (analysis between morphological components between sites) fitted with R software (R Core Team 2020) and using the lme4 library (Bates *et al*., 2015), take in account fixed effect location and time and random effects the individual. A linear regression model was used to determine the prediction equation by means of least squares by morphological component. The proposed model is as follows:

$$y_{ijk} = \mu + \alpha_i + \beta week_{ij} + \upsilon_k + e_{ijkl}$$

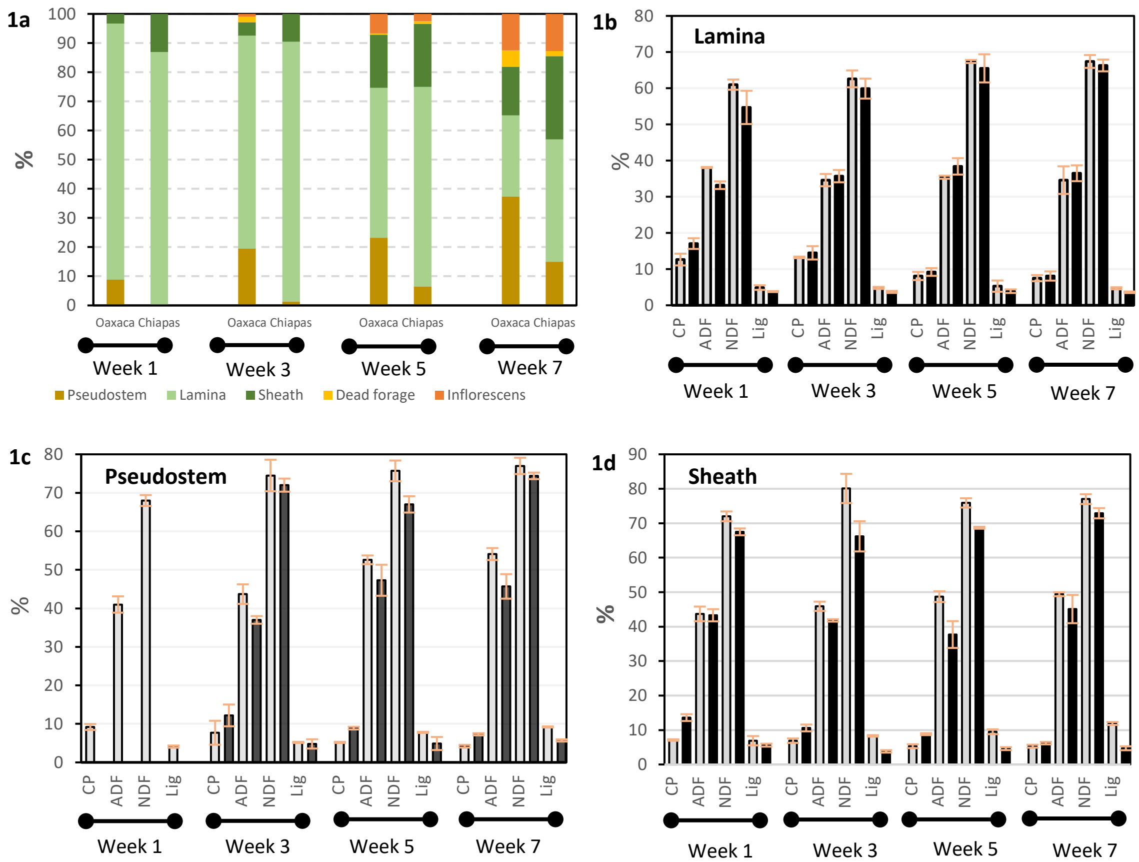
where:

y_{ijk} = is the response variable for individual $k = 1,2,3,4$, location $i = 1,2$ and time $j = 1,2,3,4$; μ = is the general means, α_i = is the location effect, β is a regression coefficient associated with time, υ_k is effect of the individual, $\upsilon_k \sim NIID(0, \sigma_u^2)$ and e_{ijk} is the residual error, $e_{eijk} \sim NIID(0, \sigma_u^2)$ where $NIID$ stands for normal independent and identically distributed, υ_k and e_{eijk} distributed independently.

RESULTS AND DISCUSSION

Nutritional changes (*P*≤0.05) among morphological components were observed over time in two tropical environments. The hostile environment conducted toward higher content of neutral detergent fiber (NDF), acid detergent fiber (ADF) and lignin, decreasing crude protein (CP) content for all morphological components. The FDA and NDF formation in the pseudostem were observed at early regrowth ages (>40% and >65 %, respectively, during the first three weeks of regrowth), while the lignin content for sheath, exceeded average values of the pseudostem. The proportion per component was different over time for both places (Figure 1a), where the highest amount of CP was observed in Chiapas for the three morphological components, being more notable in week 1 to week 3. The lamina protein in less hostile environment was 25.8% higher compare to the hostile environment (Figure 1b) with a decisive impact on the protein value of the lamina (8.1% *vs*. 7.5% for Chiapas and Oaxaca, respectively). The vulnerable environment was decisive in the low protein content at lamina level, pseudostem and sheath. For pseudostem and sheath, protein content did not register large variations over time. In hostile environments the pseudostem showed on average higher CP than the sheath (6.6 % *vs* 6.1%, respectively; Figure 1c), while in favorable environments the sheath showed a slight improvement in protein content (9.5 Vs 9.8 for Oaxaca and Chiapas, respectively; Figure 1d). In both places NDF, ADF and lignin increased over time, the ADF increase at pseudostem level for hostile environments was more noticeable (54.1 % *vs.* 41.7 %).

Figure 1. Composition (%) and nutritional dynamics by morphological component for the hybrid *Urochloa* (GP 3025) in two tropical environments. Values corresponding to rainy season in Puerto Escondido, Oaxaca and Ocozocoautla, Chiapas. Oaxaca Chiapas

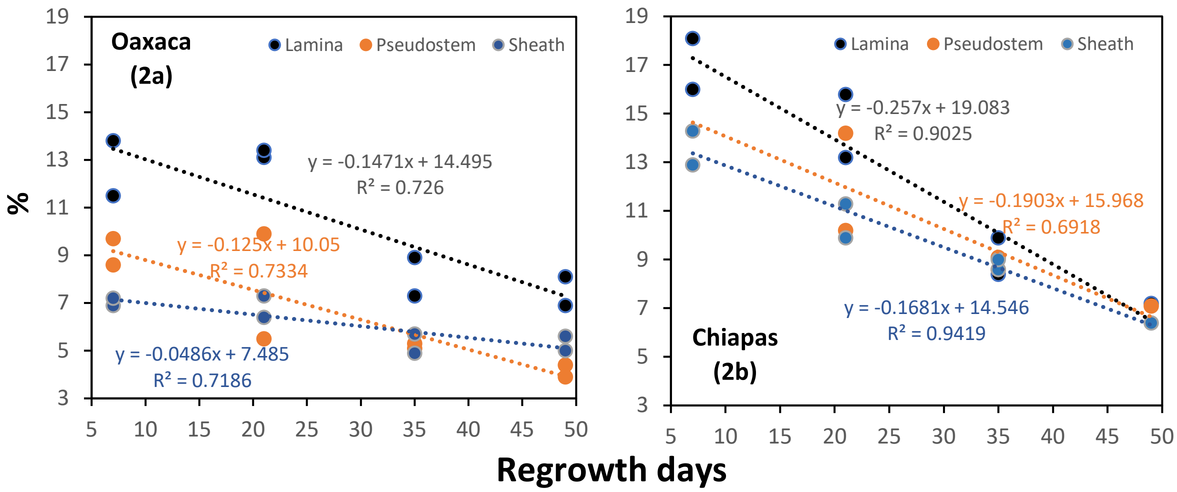


I: SEM; Standard Error Mean

The CP concentrations over time showed a negative linear regression relation for both environments and for all morphological components (Figure 2). A greater slope was observed for CP concentration reduction in samples from Chiapas, while hostile environments, the rate CP loss for all morphological components was lower. However, in both cases the greatest protein loss occurred during the third week, registering biggest up to five percent (5.2 and 5.4, Oaxaca and Chiapas, respectively). The greatest CP losses in all morphological components occurred in favorable environments, due to autophagy (degradation of oxidized proteins) and senescence including programmed cell death (PCD;

Kwon and Park, 2008). According our prediction equation on loss per unit protein over time, for hostile environments were; 1.47 g d^{-1}, 1.25 g d^{-1} and 0.4 g d^{-1} for lamina, pseudostem and sheath (Figure 2a), while favorable environments these included; 2.57 g d^{-1}, 1.9 g d^{-1}, 1.6 g d^{-1} for lamina, pseudostem and sheath, respectively (Figure 2b).

Figure 2. Changes in crude protein (CP) content per morphological components in two Mexican tropic places.



CONCLUSIONS

The favorable environments promoted higher CP concentrations for all morphological components at early stage of regrowth but did not maintain its CP concentrations over time. Hostile environments promoted both fiber and lignin aggregation within a short period; however, CP concentration's losses were accelerated for favorable growth environments. Hence it is important to consider physiological processes to explain completely nitrogen losses occurred over time.

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