Nutritional characterization of *Brachiaria decumbens* grass, under biological fertilization and harvested at three ages of regrowth

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Introduction In tropical areas, forages are the main source of food for ruminants, with the main component of tropical grasses, which are rapidly growing and maturing. Due to this characteristic, their nutritional quality also changes rapidly, since with age they experience sensitive and gradual changes in their composition. Although livestock is a growing productive activity in the area it occupies, each time its negative effects on the soil become more evident. Among the actions to protect agricultural ecosystems and prevent their degradation, the application of organic fertilizers and bacteria that promote plant growth are of significant importance, since they are the basic support for life in this environment and can define their productive potential (Sánchez et al., 2011). The purpose of this research was to evaluate the effect of biological fertilization and regrowth age on the nutritional behavior of *Brachiaria decumbens* grass.

Materials and method This investigation was carried out in a prairie of *Brachiaria decumbens* cv. Basilisk already established that belongs to the Center for Research and Technology Transfer of San Marcos, Pichincha Prefecture. Nine treatments were used which were distributed in a completely randomized block design with factorial arrangement (3:3) with 3 levels of fertilizers: SF = without fertilization, HL = liquid humus and BIOF = biofertilizer and 3 age of regrowth = 21, 35 and 49 day, with three repetitions per treatment, for a total of 27 experimental units. The block was constituted by the slope. The areas of the plots were 20 m^2 leaving 1 meter of street between treatments and 2 meters for each block. An equalization cut was made at an approximate height of 10 cm from the ground. The day after the equalization cut the biological fertilizers were applied, it was carried out in the morning at a dose of 4cc/400cc of water, previously correcting the pH of the water between 5.5 and 7. The chemical composition analysis was carried out by means of the proximal analysis proposed by the AOAC (1990). Phosphorus determinations were performed by the colorimetric method and those of calcium by the atomic absorption spectrophotometer. The total digestible nutrients (TDN; %) were estimated according to the Bath estimation formula (NRC, 1989). The results obtained were analyzed through the corresponding analysis of variance, the comparison of means through the Tukey test at a level of 5%. To establish the functional relationship between yield and regrowth age, regression equations were analyzed. For the selection of the best-fit equation, the highest value of R^2 and the high significance it presents were considered. The free version of Infostat software was used for the calculations.

Results and Discussion The CP showed significant differences ($P < 0.05$) due to the effect of fertilizers, as well as the age of regrowth, presenting a better value with the application of HL and

at the age of 35 days (Table 1). In turn, Avellaneda Cevallos et al. (2008) and Homen et al. (2010) indicated values that ranged from 7 to 13% and 9.35 to 17.50% respectively. Vega Espinoza et al. (2006) suggest that the decrease of the CP content is produced by the decrease in the metabolic activity of the pastures as the age of regrowth advances, with this the synthesis of protein compounds decreases. Regarding the EE, there was a significant effect ($P < 0.05$) for both the fertilizing factors and the regrowth age, which differ from that reported by Guzmán Cordonez (2015), which presents higher values, applying vermicomposting (3.60, 3.45, 3.58 and 4.72%) at four different ages of regrowth.

Table 1 Chemical composition and regression equations (ŷ), considering the fertilizing effect and regrowth age.

Items[1] (%DM)	Fertilizer			Age of regrowth (day)			**Equations of regression**	R^2
	SF	HL	BIOF	21	35	49		
DM	18.43[a]	18.43[a]	18.64[a]	18.67[a]	17.75[a]	19.08[a]	$\hat{y} = 0{,}0057x^2-0{,}3871x+24{,}269$	1.00
CP	9.85[b]	13.45[a]	12.37[a]	11.89[ab]	12.46[a]	11.31[b]	$\hat{y} = -0.0044x^2+0.2864x+7.81$	1.00
EE	2.28[b]	2.34[ab]	2.44[a]	2.25[b]	2.33[ab]	2.48[a]	$\hat{y} = 0.0082x+2.0658$	0.59
Ash	11.77[a]	11.66[a]	12.16[a]	12.83[a]	12.22[ab]	10.55[b]	$\hat{y} = -0.0814x+14.717$	0.47
CF	28.46[a]	28.49[a]	28.52[a]	26.42[b]	28.52[ab]	30.53[a]	$\hat{y} = 0.1468x+23.353$	0.61
Ca	0.55[a]	0.62[a]	0.55[a]	0.66[a]	0.70[a]	0.37[b]	$\hat{y} =-0.0009x^2+0.0557x-0.0937$	1.00
P	0.19[b]	0.22[a]	0.21[ab]	0.24[a]	0.23[a]	0.14[b]	$\hat{y} = -0.0002x^2+0.0107x+0.105$	1.00
TDN	55.95[a]	56.52[a]	55.81[a]	56.25[a]	55.81[a]	56.22[a]	$\hat{y} = 0.0022x2-0.1529x+58.504$	1.00

[a-b]Means in each row with equal letters do not differ statistically (Tukey $P \leq 0.05$).
[1]DM = dry matter in %; CP = crude protein; EE = Ethereal Extract; Ash = mineral matter; CF = crude fiber; Ca = Calcium; P = phosphorus; TDN = total digestible nutrients.

The Ash values were only significantly affected ($P < 0.05$) by the age of regrowth, which when compared differ and are superior to those of Vega Espinoza et al. (2006) and Guzmán Cordonez (2015). On the other hand, the values of CF and Ca only showed significant differences ($P < 0.05$) due to the effect of the regrowth age. Vega Espinoza et al. (2006) mentioned higher HR values (31.15; 32.05; 33.45; 35.55%) at four ages of regrowth. Meanwhile, Homen et al. (2010) indicated lower values of Ca with inorganic fertilization of (0.40, 0.24, and 0.38%), at the same ages studied. In turn, the P values had significant differences ($P < 0.05$) by the two factors studied, when compared with Homen et al. (2010) similarity was observed at the age of 21 days that mention the value of (0.24%) and values of (0.17%) for the other ages. The estimated values of TND were not significantly affected ($P < 0.05$) by the factors.

Conclusion The application of biological fertilizers improves the nutritional quality of the forage, primarily of the crude protein. Besides, it was determined thanks to the estimation equations that forage can be used up to the age of 41 day without having significant alterations in the crude protein.