Biomass production, elemental and fibre composition of Brachiaria produced under free air carbon dioxide enrichment conditions

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Introduction Potential effects of climate change on agriculture have being discussed for Brazilian conditions recently (Ghini, Bettiol, Hamada, 2011). Enrichment of atmospheric CO2 enhances the rate of growth of agricultural crops (Asseng *et al*., 2004). Almost 80 million ha of Cerrado land are planted with Brachiaria species, in which the beef cattle production in Brazil is grounded and this area supports much of the Brazilian beef industry. Little data exists on potential changes in chemical composition and nutritional quality of tropical forages for livestock production under the scenario of CO2 enriched atmosphere. The aim of this work was to determine the effects of two contrasting CO2 atmosphere: ambient and elevated (≈ 200 µmol mol-1 above ambient) CO2 concentrations upon the total biomass production, elemental and fibre composition a of *Brachiaria decumbens*.

Material and methods The free air carbon dioxide enrichment conditions (FACE) facility was established at Embrapa Environment (latitude 22°41'S, longitude 47°W, altitude of 570 m a.s.l.), Brazil, in order to generate field response data to elevated CO2 air concentration. Twelve 10-m-diameter octagonal rings located within a 7-ha field, six rings, representing the control treatment, were left under untreated conditions (current atmosphere), whereas other six rings have been treated with pure CO2 to achieve the concentration of 200 ppm above ambient concentration, supplied by a bulk CO2 container with the capacity of 20 t. Within each ring, two plots have been planted with Brachiaria decumbens cv basilic and after 10 weeks of growing (on January 2012), an initial cut for standardization was performed. Since then, forage availability has being estimated every 28 days. Samples of 0.25m2 were collected from each plot, through cutting with scissors the grazing portion of the stand (at 20 cm height). Collected samples have been split into two portions for determining the biomass availability, plant fractions and chemical determinations after dried at 55 °C for 72 h and ground to pass in a 1mm grinder. Biomass production and chemical composition was statistically analysed by Proc Mix (model = co2 (+ or -) date (from February to November 2012) plot (A and B) block (1 to 6)).

Results Elemental C, N and S composition (%) were not altered by enriched CO2 air concentration (44.2 vs 44.1 (s.e. 0.07); 3.2 vs 3.1 (s.e. 0.02) and 0.25 vs 0.24 (s.e. 0.003) respectively for enriched and ambient CO2 atmosphere). Biomass available, leaf fraction and ADF content were substantially altered by CO2 enrichment conditions (Table 1).

Table 1 Biomass available, plant and fiber fractions of Brachiaria decumbens cultivated under two free air carbon dioxide enrichment conditions

Brachiaria decumbens		FACE		s.e.	P
		+ CO2	ambient CO2		
Biomass available	g fresh / m^2	1442.15	1151.60	54.185	0.0001
	Kg DM / m^2	0.377	0.298	0.0164	0.0005
Plant fraction (%)	stem	17.92	16.85	0.577	0.1211
	leaf	80.10	81.62	0.675	0.0875
Fiber fractions (g/Kg DM)	NDF	644.21	637.92	3.300	0.1814
	ADF	313.59	306.75	2.098	0.0180
	LIG	61.42	58.80	2.705	0.5515
	CEL	252.17	247.95	3.118	0.2783
	HEMC	330.62	331.18	2.413	0.8098

Conclusions Despite the increase in pasture biomass available with CO2 enrichment atmosphere, the reduction on leaf proportion and increase ADF content of the material may lead to worries regarding to the sustainability of the beef production system in Brazil whilst ambient CO2 concentration maintain its increasing..

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