RESOURCE USE PATTERNS IN INVASIVE AND NATIVE GRASSES IN A CERRADO FORMATION

José Cristiano Delabio Juliano de Moraes José Ubirantan Cordeiro Maurício Perine Sérgio Tadeu Meirelles ;

INTRODUÇÃO

Invasive African grasses are an important threat to native grasslands and open “cerrado” formations (Solbrig *et al*. 1996). Similarities among African and Brazilian savannas are usually regarded as a factor contributing for the invasive habit of African grasses in the Brazilian cerrado formations (Solbrig *et al*. 1996). Considering the presumed similarities, analogous patterns of resource use can be expected among African and South-American savanna grasses. Under these premises, we ask: why are native grasses outperformed by their African counterparts? Most invasive plants are regarded as ecological opportunists, taking advantage of abundant resources when available. Opportunist invaders usually show low resource use efficiency when compared to native species in similar conditions (Pivello *et al*. 1999, Hoffman *et al*. 2004), an attribute that allows rapid growth and reproduction. Native grasses may show a stress tolerant bias, especially in the typical cerrado conditions of nutrient poor, easily drainable soils with recurring drought in the upper layers where most of the grasses have their roots. Besides, invasive grasses have high nutrient contents, a desired trait for the use as cattle forage (D’Antonio & Vitousek, 1992). How, in the nutrient poor cerrado soils, invasive grasses acquire the necessary amount of nutrients to become competitive with native grasses, originally capable of thriving on less fertile conditions? The most abundant invasive grasses in cerrado vegetation from São Paulo state are *Brachiaria decumbens* and *Melinis minutiflora*, both of African origin, introduced for cattle ranching (Pivello *et al*. 1999). Along with these species, less aggressive invasive grasses like *Hyparremia rufa* occur in small numbers in some cerrado fragments (Felfili *et al*. 1994). Considering the need to survive and to get competitive advantage in the cerrado conditions of low nutrient content and recurrent drought we expect that most of the grasses show similar patterns of water, light and nutrient use that can be adjusted seasonally. Alien grasses should cope with these conditions and overcome the competition with native grasses already installed. So, we expect a higher plasticity in the alien grasses combined with a strong opportunistic behavior when compared with the native grasses (Feng *et al*. 2007).

OBJETIVOS

The aim of this work is to investigate the patterns of resources use in native and alien grasses in a “campo sujo” type of cerrado in the Parque Estadual do Juquery – SP – Brasil.

MATERIAL E MÉTODOS

The Juquery State Park is located at the city of Franco da Rocha near São Paulo (23°21'S, 46°42'W) with an area of 1927.70ha, having an average elevation of 920m (Figueiredo *et al*. 2000). The local climate is classified as humid mesothermal, with well-defined seasonality (Köppen, 1949). Annual mean temperature is around 20ºC. The rainy season is concentrated in the summer period from October to February. The annual rainfall is 1300mm to 1700mm. The soil is characterized as dystrophic dark red with thickness around one meter. For the comparisons we have chosen a set of the most common native grasses in the cerrado that usually occur with the studied invasive grasses *Brachiaria decumbens* and *Melinis minutiflora*. The native grasses were *Axonopus siccus*, *Axonopus barbigerus*, *Tristachya leiostachya*, *Imperata brasiliensis* and *Echinolaena inflexa*. Plants of the selected species were studied in field conditions in sites where they grouped together. The sites were located along dirt road accesses used for security and fire management. In order to consider the studied plants occurring in similar conditions of available resources we focused our investigation in groups of invasive and native grasses on dirt road borders next to the campo sujo vegetation. The resource use was inferred throughout techniques of gaseous exchanges measurements and chlorophyll fluorescence induction. The procedures included year long monthly measurements and a week long daily measurements during the wet season to characterize short term dynamics. Leaf gaseous exchanges allowed to estimate assimilation values (A, umolCO2.m-2.s-1); stomatal conductance (g, umol.CO2.m-2.s-1…); transpiration rate (E, molH2O.m-2.s-1) and water use efficiency (WUE, (CO2.m-2.s-1/ mol H2O m-2.s-1). Light use dynamics was investigated using saturation pulse techniques to estimate electron transfer rates (ETR, umol m-2.s-1) and photoinhibition (Bjorkman & Demmig, 1987).

RESULTADOS

Point measurements values among native and invasive grasses were quite similar considering the precipitation regime. During the dry season, average values were (mean±sd) for natives: A = 9.98±4.30; g=0.0898±0.05826; E=2.46±1.83; WUE=5.82±4.94 and ETR=18.78±7.79. For invaders: A= 10.23 ± 6.46; g = 0.0467 ± 0.02591; E = 1.25±0.7428; WUE=8.69±3.81 and ETR=15.29±5.26. During the wet season, average values were: for natives: A=15.72±6.78; g=0.1887±0.22700; E=3.24±1.69; WUE=7.28±8.47 and ETR=40.42±16.67. For invaders: A=15.69±6.96; g=0.1473±0.1393; E=2.23±1.42; WUE=9.32±5.40 and ETR=34.75±21.96. Although highly dispersed, parameters values show some tendencies that allow comparisons. Both, invasive and native species, showed a reduction in transpiration and stomatal conductance during drought, which is the probable cause of reduction in the mean assimilation values.

DISCUSSÃO

Daily dynamics of gaseous exchanges during wet season show higher values of CO2 assimilation for invasive grasses. The high assimilation rates in invaders seems to be less affected by the daily changes of temperature and relative humidity when compared to most of the native species. In native grasses, assimilation is clearly dependant on stomatal conductance. The variations in ETR values were divergent from assimilation rates in most of the native species. In native grasses the electron transfer rate reached the maximum values when assimilation rate declined during midday. Many of these features allow us to suggest that native grasses have a tendency toward a parsimonious resource use strategy whereas invaders show an opportunistic strategy. In spite of the aggressive resource use, invaders showed higher water use efficiency (WUE) with less impact during the dry season.

CONCLUSÃO

- Average assimilation values are not sufficient to explain the invasive ability of the African grasses *M.minutiflora* and *B.decumbens*. - Reduction in stomatal conductance can have a stronger impact in the carbon gain of native grasses when compared to the invasive *M.minutiflora* and *B.decumbens*.

REFERÊNCIAS BIBLIOGRÁFICAS

BJORKMAN, O. & DEMMIG, B. Photo yield of O2 evolution and chlorophyll fluorescence characteristics at 77K among vascular plants of diverse origins. Planta 170:489-504, 1987.

D'ANTONIO CM,VITOUSEK ,P.M. 1992. Biological invasions by exotic grasses, the grass/fire cycle, and global change. Annual Review of Ecology and Systematics 23: 63–87.

FELFILI, J. M. *et al*. Projeto biogeografia do bioma cerrado: vegetação e solos. Cadernos de Geociências, v. 12, n.4, p. 75-166, 1994.

FENG,Y.L,WANG,J.F, SANG,W.G. 2007.Biomass allocation, morphology and photosynthesis of invasive and noninvasive exotic species at four irradiance levels. Acta Oecologia 31,40-47.

FIGUEIREDO, L. F. A.; GUSSONI, C. O. A.; CAMPOS, R. P. 2000. Levantamento da avifauna do Parque Estadual Juquery, Franco da Rocha, São Paulo: Uma avaliação auto-crítica das técnicas de campo para investimentos ornitológicos. Boletim CEO, 14: 36-50.

HOFFMANN ,W. A., LUCATELLI V. M. P. C., SILVA F. J. *et al*. (2004a) Impact of the invasive grass Melinis minutiflora at the savanna-forest ecotone in the Brazilian Cerrado. Divers.Distrib. 10, 99–103. KÖPPEN, W. 1948. Climatologia: con un estudio de los climas de la tierra. Fondo de Cultura Econômica. México. 479p.

PIVELLO, V. R., SHIDA, C. N. & MEIRELLES, S.T. 1999. Alien grasses in Brazilian savannas: a threat to the biodiversity Biodiversity and Conservation 8: 1281-1294.

SOLBRIG, O. T., MEDINA, E., AND SILVA, J. F. (1996). Determinants of Tropical Savannas. In: Biodiversity and Savanna Ecosystem Processes: A Global Perspective (eds.O. T. Solbrig, E. Medina, and J. F. Silva).pp.31-39. Springer-Verlag, Berlin.

Agradecimento

Ao CNPQ pela bolsa concedida, e a todos os funcionários do Parque Estadual do Juquery.