Carbon isotope discrimination in sugarcane to identify and quantify production losses due to water and nitrogen stress

Oriel T. Kölln[1]; Glauber J. C. Gava[2]; Paulo Cesar Ocheuze Trivelin[1]; Heitor Cantarella[3]; Mauro Wagner de Oliveira[4]

[1]Centro de Energia Nuclear na Agricultura CENA/USP, Av. Centenário, 303, Cep: 13400-970, Piracicaba/SP, orielkolln@cena.usp.br, pcotrive@cena.usp.br.[2]APTA - Pólo Centro Oeste, Rodovia SP-304, km 304, CEP 17201-970, Jaú, SP, ggava@apta.sp.gov.br. [3]Instituto Agronômico de Campinas IAC, Av. Barão de Itapura, 1481, CEP:13020-920, Campinas, SP, cantarella@iac.sp.gov.br. [4]Universidade Federal de Alagoas, mwagner@ceca.ufal.br

The interactions between water and nitrogen stresses on sugarcane yields are not well understood despite the importance of these factors for plant growth. A possible way to evaluate this interaction is the use of the $^{13}C\Delta$ isotope discrimination technique, because it is an indirect measure of plant physiological response to the environment. Zero value of $^{13}C\Delta$ indicates lack of discrimination (plants without stress), while positive values indicate stressed plants. Therefore, the purpose of this study was to quantify the total yield loss (TYL) due to water (YLWS) or nitrogen (YLNS) deficiency stresses as related with carbon isotope discrimination. The experimental design was a randomized block design with four replications and four treatments: T1-irrigated unfertilized with N, T2-dryland unfertilized with N, T3- irrigated and fertilized with 140 kg N ha^{-1} and T4-dryland and fertilized with 140 kg N ha^{-1}. The genotype used was SP80-3280. At the end of the plant cycle (365 days after harvest previous crop), leaf (+1 leaf) samples were taken to determine the isotopic fractionation ($^{13}C\Delta$) in the mass spectrometer. Stalk dry matter yields (SDM) of sugarcane were also evaluated. The results showed significant differences between treatments. The dry matter yields of stalks were 18, 24, 27 and 39 Mg ha^{-1} and $^{13}C\Delta$ values were 4.957, 4.660, 4.755 and 4.418 ‰ respectively for T2, T1, T3 and T4. Calculated yield losses were 32% due to water stress and 40% due to N stress; for both stresses a 55% yield reduction was observed. The $^{13}C\Delta$ was shown to be a useful stress index in studies of the interaction between N and water in sugarcane.

Supported by "FAPESP (Proc. 08/56147-1)