Geophysical Research Abstracts
Vol. 20, EGU2018-789-2, 2018
EGU General Assembly 2018

Influence of water stress on the water use efficiency and biological nitrogen fixation of soybean by means of stable isotopes

Maria Magdalena Warter (1), Henk Ritzema (1), Paul Struik (2), Gerd Dercon (3), and Maria Heiling (3)

(1) Wageningen University and Research, Water Resource Management, Wageningen, The Netherlands (m.warter@hotmail.com), (2) Wageningen University and Research, Plant Sciences, Wageningen, The Netherlands, (3) Soil and Water Management & Crop Nutrition Laboratory, Joint IAEA/FAO Division of Nuclear Techniques in Food and Agriculture, Department of Nuclear Sciences and Applications, International Atomic Energy Agency, Vienna, Austria

Limited water resources and prolonged periods of water stress can have severe effects on crop growth and production. Current research efforts are directed towards finding and selecting more drought tolerant species and a better understanding of drought and water limited environments on crop performance. A pot experiment was conducted in a climate chamber at the Joint IAEA/FAO laboratories in Seibersdorf, Austria, using the soybean variety *Sigalia* and summer wheat *(Triticum aestivum)* as a reference crop. The experiment consisted of two watering regimes, one optimal and one stressed, with 12 replicates each. Soil water content in optimal pots was kept between 80-100% field capacity whereas stressed plants were kept at 20-30%. There were two stages of treatments; from 0-15 days all plants were well watered to ensure plant growth and from 15-42 days crops were subjected to either optimal or stress treatments. Plants were weighed daily and weight changes recorded to track irrigation gifts. Stress symptoms became visible after 14 days of the start of the second treatment stage. Plants were harvested after a total growing period of 42 days. The aim of the experiment was to test carbon isotopic discrimination *(CID)* and the isotope dilution method by using the stables isotopes of ^{13}C and ^{15}N and to determine the effects of drought stress on water use efficiency *(WUE)* and biological nitrogen fixation *(BNF)*. The isotope dilution method was used as a tool to determine the amount and source of N within the crops. The ^{13}C values varied in the range of -27 to -30‰ for well-watered and -25 to -28‰ for stressed soybeans, indicating a clear and significant effect of water treatments on the isotopic signature. *BNF* was ultimately not measurable in soybeans at the point of harvest. Instead the same data was used to assess the fertilizer N utilisation rate of the applied starter fertilizer, in both soybean and wheat. Water treatments showed a significant influence on the N utilisation rate with average values of 76% for well-watered and 27% for stressed soybeans. *WUE* was highest for well-watered plants with an average of 2.2 kg/m^3 and 1.1 kg/m^3 for stressed plants. This result is unusual and could be an effect of the application of the water treatments and the N availability in the crops.