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To cite this version:
Issam Moussa, Florian Fort, Claire Jouany, Eric Lecloux, Pablo Cruz, et al.. Use of isotopic discrimination (d13C and d15N) for screening drought tolerance of legume grassland plants. Joint European Stable Isotopes User Group Meeting (JESIUM 2016), Sep 2016, Ghent, Belgium. 1 p., 2016. hal-02794225

HAL Id: hal-02794225
https://hal.inrae.fr/hal-02794225
Submitted on 5 Jun 2020

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Use of isotopic discrimination (δ¹³C and δ¹⁵N) for screening drought tolerance of legume grassland plants.
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Objectives of the study
As a consequence of Global Changes, perennial pastures have to face more and more extreme climatic conditions such as longer drought periods which impact forage production and, as a consequence, reduce the sustainability of livestock systems. In that context it is important to evaluate the capacity of grassland species to tolerate water shortage. This point is of major interest for Fabaceae, the most frequent family after Poaceae in grassland ecosystems, since they allow application of N fertilizer to be reduced while maintaining acceptable production levels.

Methodology
In that purpose, we set 2 experiments which aimed at screening the drought tolerance of grassland species
(i) in 2012 we grew, on soil columns, 14 Fabaceae and 6 grasses under controlled environment in a greenhouse under four growth conditions, by crossing two levels of both Phosphorus and water availability;
(ii) in 2013, 24 Fabaceae and 4 Poaceae were seeded in a common garden on 2 m² plots and grown under full water availability; in both experiments, species were randomly distributed in 4 repetitions blocks.

The 2012 greenhouse experiment view and the 14 first Fabaceae species

Some results of the green house in 2012

Results plot 2014-2015

On the field site, with no limitation of water, the surprise was that same Mediterranean species, like Anthyllis montana, Astragalus monspess and Coronilla minima, present highly positive δ¹⁵N values (from +5.54 to +9.24 ‰). This result was find for both 2014 and 2015. These plants also displayed the higher C/N values (>15).

Conclusion
There is very few investigations about the use of nitrogen isotopes for the study of grassland plants. M. Unkovich (New Phytologist 2013) has shown that isotope discrimination of δ¹⁵N provides new insight into biological nitrogen fixation.

In our case, the positive δ¹⁵N values find for the Mediterranean species could indicate that these plants, in these growing conditions, are no more able to fix correctly the Air N₂. Further measurements will be made on roots and nodules.

References:

Acknowledgements: Legum program (2014-2016)

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