

Divergent selection of *Lotus corniculatus* and *Lotus uliginosus* for water stress and root characteristics

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The conventional breeding is an efficient tool in factors with low environmental effect, where the phenotype expression is close to genotype. On the contrary, the selection for complex characteristics such as tolerance to water stress has severe restrictions in the design of breeding programs that achieve significant progresses in each generation. In the frame of the Project LOTASSA (FP6-2003-INCO-DEV2 PL-517617) financed by the European Union, the development of contrasting populations and their metabolic and molecular study was planned to expand strategies for the conventional breeding. The present study describes the process and the first results of the divergent selection of *Lotus corniculatus* and diploid *Lotus uliginosus* for tolerance to water stress and root characteristics. 1900 plants of *L. corniculatus* cv. San Gabriel and INIA Draco was sowed in April 2006 in pots with a mixture of soil, horticultural substrate, sand and vermiculite in equal proportions. The pots were maintained at 70% of field capacity during the first month to develop vigorous seedlings; afterwards a reduction to 40% of field capacity was established and 3 yield evaluations of fresh forage were carried out (July 26, October 18, November 30). In May 2006 1900 plants of diploid *L. uliginosus* were established following the sama procedure for *L. corniculatus*. The evaluations were carried out August 22, November 8 and January 9 2007. After the evaluation of forage of the second regrowth, the crown diameter, diameter of the main root at different depths and the size and location of the main lateral roots was quantified. The average yield of *L. uliginosus* in the first cut was 4.89 g FW/plant, with a range of 0.56 to 14.57 g FW/plant. The yield of the first regrowth during the water stress period was 6.26 g FW/plant, with a range of 0.51 to 17.45 g FW/plant; while the yield of the second regrowth was much lower (average 3.52 g FW/plant and range from 0.1 to 15.1). Tolerant and sensitive plants were selected within the group of plants with good initial development (first cut), considering the extreme yields in the two regrowth evaluated during the period of water stress. The groups selected as tolerant and sensitive yielded 6.74 (range 2.65 at 12.72) and 7.34 (range 5.75 at 12.06) g FW/plant, respectively, overcoming to the general mean. The first and second regrowth of the tolerant group yielded 10.45 on average (range 4.72 at 14.74) and 7.72 g FW/plant (range 3.12 at 15.1). In contrast, the sensitive group yielded 6.08 (range 2.05 at 10.23) and 2.96 (range of 1.07 at 5.39) in the first and second regrowth, respectively. The groups selected as tolerant and sensitive in *L. corniculatus* were similar in the initial yield (6.56 and 6.23 g FW/plant, respectively), but they differed markedly in the regrowth. The average difference between both groups was 2.5

g FW/plant in the first regrowth (tolerant with 6.21 and sensitive with 3.71), while the difference in the second regrowth decreased to 1.66 g FW/plant when a general reduction in the yields (tolerant 3.74 sensitive vs 2.08) has being observed. Foliar samples of some individuals were taken to relate their performance to water stress with metabolites concentration such as proline. The phenotypic evaluation identified a wide variation either in the growth under water stress or in the root characteristic radicales for both species.