

## BREEDING OF THE ALFALFA STEM MORPHOLOGY FOR QUALITY TRAITS

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The protein production capability in alfalfa is mainly related to the leaf/stem ratio at cutting: the tolerance to early cutting (5% blooming), the modification of stem morphology towards a higher number of shorter internodes and the uncoupling rate of growth and rate of development are the different approaches used in the breeding programs of ISCF Lodi to act on leaf/stem ratio.

The results obtained on stem morphology by means of positive selection for plant dry matter (DM) and divergent selection for the average internode length, applied through two cycles of selfing are reported. The parental populations were represented by S<sub>1</sub> progenies of plants from somatic hybridisation *M. sativa* x *M. falcata* crossed to non-inbred *M. sativa* of different origins.

The S<sub>2</sub> individuals selected with short and long internode length (SI and LI respectively) were polycrossed to obtain Syn1 and Syn2 generation synthetics; besides, five simple hybrids S<sub>2</sub>xS<sub>2</sub> were obtained in the SI material. The Syn2 experimental synthetics (1600 plants/synthetic), the simple hybrids (760 plants) and four tester varieties (640 plants) were then grown in miniplots at the density of 400 plants m<sup>2</sup>, with not limiting irrigation. Five cuts were done in the sowing year 2004 and in the 1<sup>st</sup> productive year 2005; stem morphology (total stem height at the 1<sup>st</sup> reproductive node, number of vegetative and reproductive nodes) and DM yield were studied at individual plant basis in cuts 2 to 4 (2004) and 1 to 5 (2005). A subsample of individuals homogeneous for total stem height ( $>x + 1s$ ) and biological stage was used for leaf and stem separation and for chemical analyses of DM constituents: crude protein, determined by the Dumas method (Kirsten, 1983) and fiber fractions of the stems, according to Goering and Van Soest (1970).

The two synthetics SI and LI resulted to differ significantly for stem morphology: the number of vegetative internodes was higher in SI compared to LI in cuttings 2 and 4 (2004) and 3-5 (2005), the differences ranging from 0.5 to 1.1 vegetative internode. Total stem height and DM yield were also higher in SI in comparison with LI in cuttings 3-5 (2005). Both the synthetics differed from the tester cultivars for vegetative internode length in all the cuts studied and for number of vegetative internodes in cuts 2, 3 (2004) and 3-5 (2005). When the subsample homogeneous for stem height was considered, the differences between the SI and LI synthetics were maintained with a similar range (0.5 – 1.07) in the number of vegetative internodes; such a difference corresponded to a significant increase in leaf/stem ratio in SI synthetic compared to LI in cuttings 2 and 3 (2005): 0.77 vs 0.70 on average. Chemical analyses indicated that crude protein percentage of leaves and stems was higher in LI synthetic compared to SI; however, total protein production per plant was significantly superior in SI material because of the higher amount of leaves. The comparison of the two synthetics for the percentage of fiber fractions indicated a higher lignification in SI material in presence of an NDF content of similar value.

The interest of the experimental synthetics in comparison with the commercial cultivars for higher leaf/stem ratio and lower earliness is confirmed, the divergent selection applied appears to have been successful in modifying the number of vegetative internodes and consequently the leaf/stem ratio and the amount of protein produced per plant. The stem morphology of SI synthetic, however, has brought to a higher lignin content, whose role in feeding value has to be evaluated.