Breeding of the alfalfa stem morphology for quality

Scotti C., Gnocchi G. and M. Carelli

Istituto Sperimentale Colture Foraggere- C.R.A., V.le Piacenza 29, 26900 Lodi (Italy)

The protein production 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 (reproductive stage) 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_1 progenies of plants from somatic hybridisation *M. sativa* x *M. falcata* crossed to non inbred *M. sativa* of different origins.
The S_2 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_2xS_2 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 25x80 cm at the density of 400 plants m^{-2}, with not limiting irrigation. Five cuts were done in the sowing year 2004 and in the 1st productive year 2005; stem morphology (total stem height and height at the 1st 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 sub-sample of individuals homogenous for total stem height (>x+1*s*) and biological stage was used for leaf and stem separation.
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 with respect to LI in cuttings 3-5 (2005). Within the SI stem morphology, the synthetic variety model resulted more yielding, on average, than simple hybrid model; however, the best productive results were obtained by a simple hybrid. Both the synthetics differed from the tester cultivars for vegetative internode length in all the cuts studied and for the number of vegetative internodes in cuts 2,3 (2004) and 3-5 (2005). When the sub-sample homogenous 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. 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.