Towards Alfalfa Free-hybrids. Comparison between Free-hybrids and the corresponding Synthetics

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General objectives: a)Construction of free-hybrids in alfalfa (*Medicago sativa* L.),using partially inbred (S_2) parental plants (Rotili et al., 1999). b)Experimental evaluation of free-hybrids and synthetics derived from the same parental plants (Table 1).

Table 1. Free-hybrid program

	4 - constituents		8 - constituents	
	A B C D		E F G H I L M N	
1997	Diallel cross		Diallel cross	
1998	6 $2S_2$Syn1(SH)	$4S_2$Syn1	16 $2S_2$Syn1(SH)	$8S_2$Syn1
1999	6 $2S_2$Syn2	$4S_2$Syn2	8 S_2DHF_1	$8S_2$Syn2
2000	6 $2S_2$Syn3	$4S_2$Syn3	8 S_2DHF_2	$8S_2$Syn3
2001	Diallel cross		Diallel cross	
	15 S_2DH	$4S_2$Syn4	28 S_2OH	$8S_2$Syn4
2002-03	Agronomic Test			

SH: Simple Hybrid; DH: Double Hybrid; OH: Octuple Hybrid

The trial was planted in a cold greenhouse, in concrete boxes 25x80x65 cm containing two rows of plants (final density of 250 plants/m^2), in a randomized block design with 5 blocks. Data were collected on the 15 central plants of each row, each population being represented by 150 plants; irrigation was not limiting. Five cuttings were made during the sowing year and five in the 1st productive year; dry matter yield, earliness and mortality were recorded at plot basis.

The two free-hybrid models differed for the partitioning of the total variance: 4-constituents free-hybrids, built up with S_2 individuals originating each from different germplasm sources (groups A and B), derived the major part of their variation from SCA component. Significant and positive high parent heterosis values were observed for the majority of the hybrids, ranging from +119 to +20% (group A) and from +82 to +27% (group B). On the contrary, in the 8-onstituents free-hybrids, formed by S_2 individuals originating each from different germplasm sources (groups C), each from two different sources (group E) and each from a single cultivar (group D), the GCA component was prevailing over SCA. Significant and positive cases of high parent heterosis were limited to two Octuple Hybrids in group C and one in group E. Considering the productive performance of the free-hybrids compared with the corresponding synthetics (Syn4 generation), a single 4-constituents free-hybrid significantly outyielded the synthetic (+25%) and two showed higher dry matter production (+16 and +19%), though not significant. On the contrary, 8-constituents free-hybrids were on average significantly less vigorous than the corresponding $8S_2$Syn4 and none of them outyielded the synthetic.

The 4-constituents free-hybrid model seems of interest for the role of SCA , the high heterosis values estimated and for the possibility of improving DMY with respect to the corresponding synthetic.