

## Heterotic performance of a broad range of sativa-falcata hybrids

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Progeny of *Medicago sativa* subsp. *sativa* by subsp. *falcata* crosses show high-parent (HP) heterosis for biomass yield (Riday and Brummer, 2002a). High-parent heterosis is uncorrelated with parental yield *per se* and is desirable for hybrid breeding goals. However, sativa-falcata hybrids show slower regrowth and earlier fall dormancy than elite sativa germplasm (Riday and Brummer, 2002b). Our research objectives are to develop a holistic model of sativa-falcata heterosis that moves beyond just quantitative genetic mechanisms to include climate and population components (Fig. 1). This model, in-turn, could lead to heterosis prediction and possible QTL detection, enabling breeders to maximize yield improvement while minimizing negative agronomic effects of sativa-falcata hybrids. To elucidate the sativa-falcata heterotic pattern in terms of phylogeography, we selected a broad range of falcata and subsp. *varia* genotypes, both from across their native ranges and from semi-improved populations, and

testcrossed them to four elite sativa populations. In total, we are evaluating 126 genotypes from 45 alfalfa accessions, each represented by one to five genotypes. Sixteen genotypes are elite sativa material. All 126 genotypes were testcrossed to four elite sativa germplasm sources. Clonal cuttings and testcross progeny of the 126 genotypes were planted at two Iowa locations in autumn 2000 and are being evaluated in 2001 and 2002, for a total of four environments. For each of the selected genotypes, we calculated HP-heterosis.

We have determined first harvest yield over two years. We have also clustered genotypes based on eco-geographic variables measured at the location at which each accession was collected. Total yearly biomass yield, morphological trait measurements, and genetic marker data will be gathered by the end of 2002.

Analysis of 2001 total yearly biomass HP-heterosis ranged from -30% to 70% among genotypes. Falcata genotypes showed higher mean levels of and greater variance for HP-heterosis than did elite-sativa genotypes. Climatic variables that differentiate northern from southern latitudes are associated with HP-heterosis.

### References:

Riday, H., and E.C. Brummer. 2002. Forage yield heterosis in alfalfa. *Crop Sci.* 42:716-723.

Riday, H., and E.C. Brummer. 2002. Heterosis of agronomic traits in alfalfa. *Crop Sci.* 42:1018-1087.

