Relationship Between Seed Set Yield and Forage Yield in Alfalfa

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Inbreeding depression in alfalfa (*Medicago sativa* L.) is a concern during the development of synthetic and hybrid cultivars due to the resulting loss of vigor and decrease in heterosis. Though alfalfa breeding efforts have led to improved cultivars with high cross to self-fertility ratios (Holland and Bingham, 1994), the potential for inbreeding is still a concern. Increasing self-incompatibility would help alleviate this problem, but studies by Wilsie (1958) indicated a relationship between inbreeding and self-incompatibility as self-incompatibility increased significantly after just one generation of inbreeding from the S1 to the S2 generation.

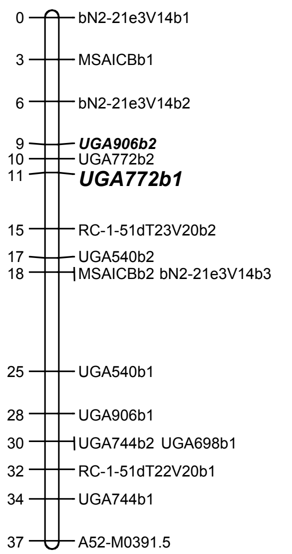

Figure 1. Linkage group of ABI-408 containing markers UGA772b1 (associated with forage yield and self-seed set) and UGA906b2 (associated with forage yield). This proposed linkage group exhibits homology to three of the previous alfalfa maps. Group 4b (Brummer et al., 1992), group 7 (Kalo et al. 2000), and group 8 (Brouwer and Osborn, 1999).

We created an F_1 alfalfa population of 200 individuals from the cross of ABI-408 (*M. sativa* subsp. *sativa*) x WISFAL-6 (*M. sativa* subsp. *falcata*). Preliminary genetic linkage maps have been created for both parents using RFLP and AFLP markers. Using clonal propagation, progeny were evaluated for forage yield at two Iowa locations over four years. Self-seed set data were collected on three replications of each F_1 genotype in the greenhouse.

The phenotypic correlation (r=0.235, p=0.0009) between the number of seeds per pod and yield supports the relationship elucidated by Wilsie. Single marker analysis, using the genetic maps and phenotypic data, identified markers associated with forage yield and self-seed set (several markers in both maps). However, only one marker (UGA772b1), from the ABI-408 map, is associated with both traits (see Fig. 1). Its presence is associated with higher forage yield and higher self-seed set and it closely maps to another marker (UGA906b2) that is associated with forage yield.

As we add more markers to the map, we will be able to use better QTL mapping techniques, such as interval and composite interval mapping, for more precise estimations of QTL location. Ideally, as the map improves, we will be able to use marker-assisted selection to increase self-incompatibility while increasing forage yield at the same time.

References:

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