Drought Tolerance in Tetraploid Alfalfa

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Introduction Alfalfa is one of the most important cultivated forage legumes worldwide . Drought is one of the most important factors limiting yield in crop plants , including alfalfa . Drought tolerance mechanisms are genetically and physiologically complex indicating a quantitative inheritance (Valliyodan et al ., 2006) . The objectives of this study were to identify quantitative trait loci (QTL) associated with yield under drought stress and to develop and map molecular markers derived from transcription factor genes sequences previously implicated in drought tolerance .

Materials and methods Biomass yield under both irrigated and drought conditions was measured in the progenies of two alfalfa backcross populations (CHBC and MFBC) derived from the germplasm *M . sativa* subs . *sativa* var . Chilean [high yield , low water use efficiency (WUE)] and *M . sativa* subsp . *falcata* var . Wisfal (low yield , high WUE) for two yrs (2006 and 2007) . The field design was a RCBD with four replications . Biomass was harvested for irrigated cycles in May and June , and drought cycles in July and August . Sequence-tagged-site (STS) markers were developed for two transcription factor gene families (Tran et al ., 2004 ; Zhang et al ., 2005) and mapped based on a SSR framework map .

Results The two parents had a statistically significant difference in yield in 2006 (Table 1) . The F1 progeny had a higher yield than both parents in 2007 suggesting that both parents contributed positive alleles for yield . The BC progeny showed a normal distribution (Figure 1) . Molecular markers for genes did not co-locate with yield QTL under drought stress .

Table 1 *Backcross population yield summary under drought and irrigated conditions .*

	May 06	June 06	July 06	Aug 06	May 07	June 07
Falcata	2005b	2017c	381b	129c	2912a	1452b
Chilean	2711a	3042a	733a	322b	3147a	1437b
F1	2557a	2423b	498b	656a	3371a	1691a
CHBC						
Mean	2394	2475	590	363	2651	1639
MFBC						
Mean	2438	2306	554	339	2771	1664

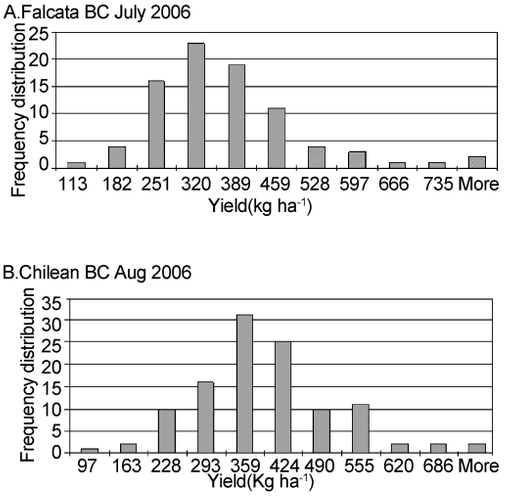

Figure 1 *Biomass yield under drought conditions .*

Conclusions Further characterization is needed to increase our understanding of drought tolerance mechanisms in alfalfa and identify physiological mechanisms associated with biomass yield under drought conditions . The feasibility of using molecular markers to enhance drought tolerance in an alfalfa breeding program requires additional evaluation .

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