

Summary of publication No. (6)

Title: Marker–trait association for grain weight of spring barley in well-watered and drought environments

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Abstract

Climate change will increase the effect of drought stress which is one of major constraints for barley production and productivity in Egypt. Identification and development new cultivars having a high drought tolerance combined with a high yield are urgently needed. In this study, a set of 60 highly homozygous and diverse barley genotypes was evaluated in well-watered (N) and dry (D) environments for two successive seasons. Five yield traits were scored; plant height, spike length, days to flowering, grain yield per spike (GYPS), and thousand kernel weight (TKW). High genetic variation was found among genotypes in all studied traits under N and D. High heritability for all traits was observed in both seasons. The drought susceptibility index (DSI) for GYPS and TKW was estimated to determine the tolerant and susceptible genotypes in both seasons. As a result, four spring barley genotypes were considered drought tolerant for TKW and GYPS in both seasons. A set of ten single sequence repeats primers, developed from wheat genome, were tested in the 60 genotypes. All SSR primers had a high polymorphism among the genotypes producing 82 marker alleles. Single marker analysis was performed for DSI, TKW, and GYPS in both seasons. Twenty QTLs were found to be associated with low DSI and high GYPS and TKW in N and D. The marker alleles associated with the 20 QTL were screened in the four tolerant genotypes. PNBYS15 included only one marker allele associated with one QTL, while, SCYT-28 included six marker alleles controlling nine QTL. The high genetic variation and heritability for the studied traits indicated that these traits could be used for selection for high yielding and drought tolerance. The four drought tolerant genotypes can be used for a further breeding program to improve drought tolerance in barley.

Keywords: Barley, grain weight, QTL, TKW, associatio