



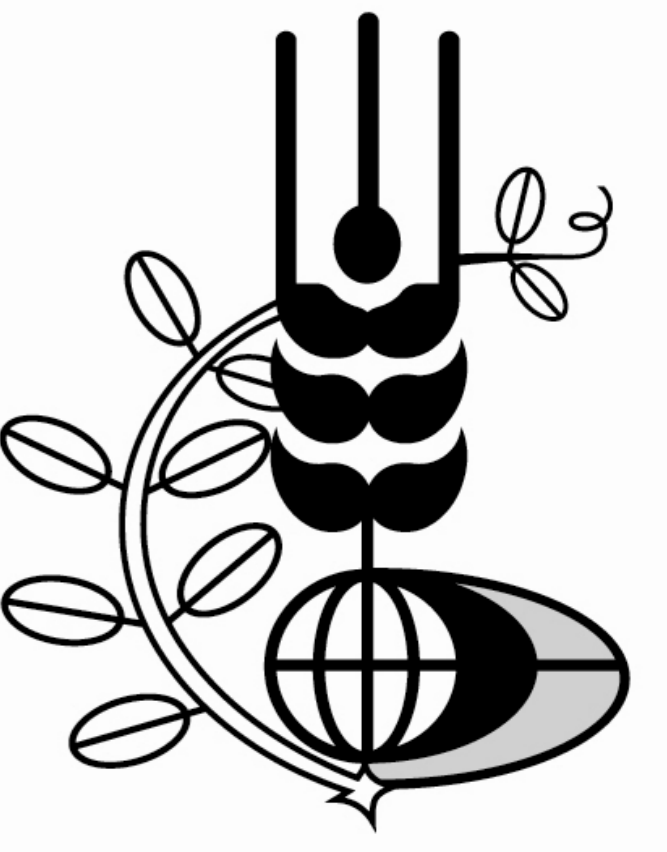
Max Planck Institute for Plant Breeding Research

QTL associated with adaptation to Mediterranean Dryland conditions in the barley cross Arta x Keel

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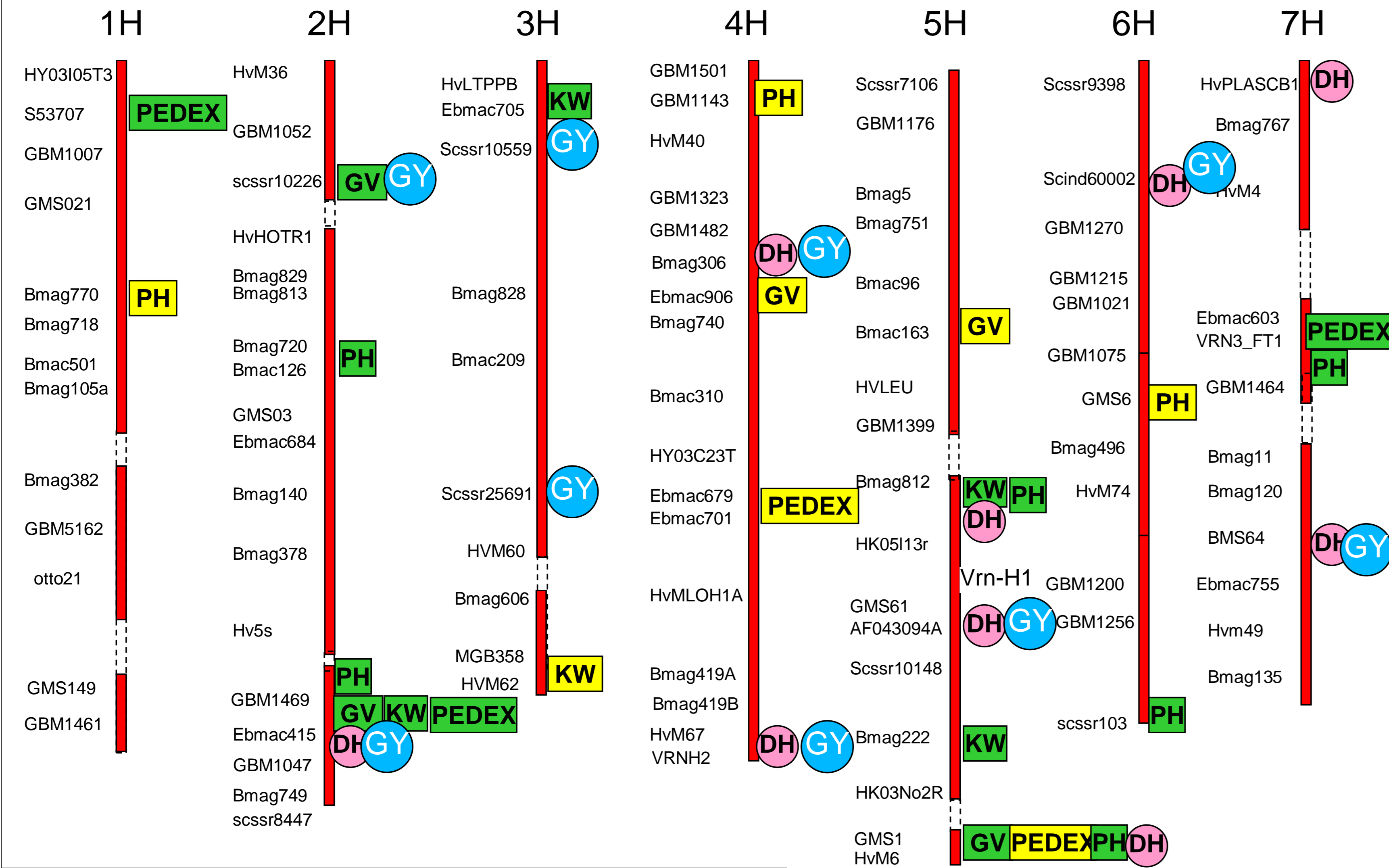


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Introduction and Objectives

The study aims at identifying the genetic basis for agronomic performance in dry Mediterranean environments. We use a QTL approach to map different agronomic traits recorded in the field and physiological and protein changes in the RILs grown under drought in the greenhouse.

QTL Analysis for Agronomic Traits under Drought in RILs (Arta x Keel)



DH = Heading date
 GY = Grain yield
 KW = Kernel weight
 PH = Plant height

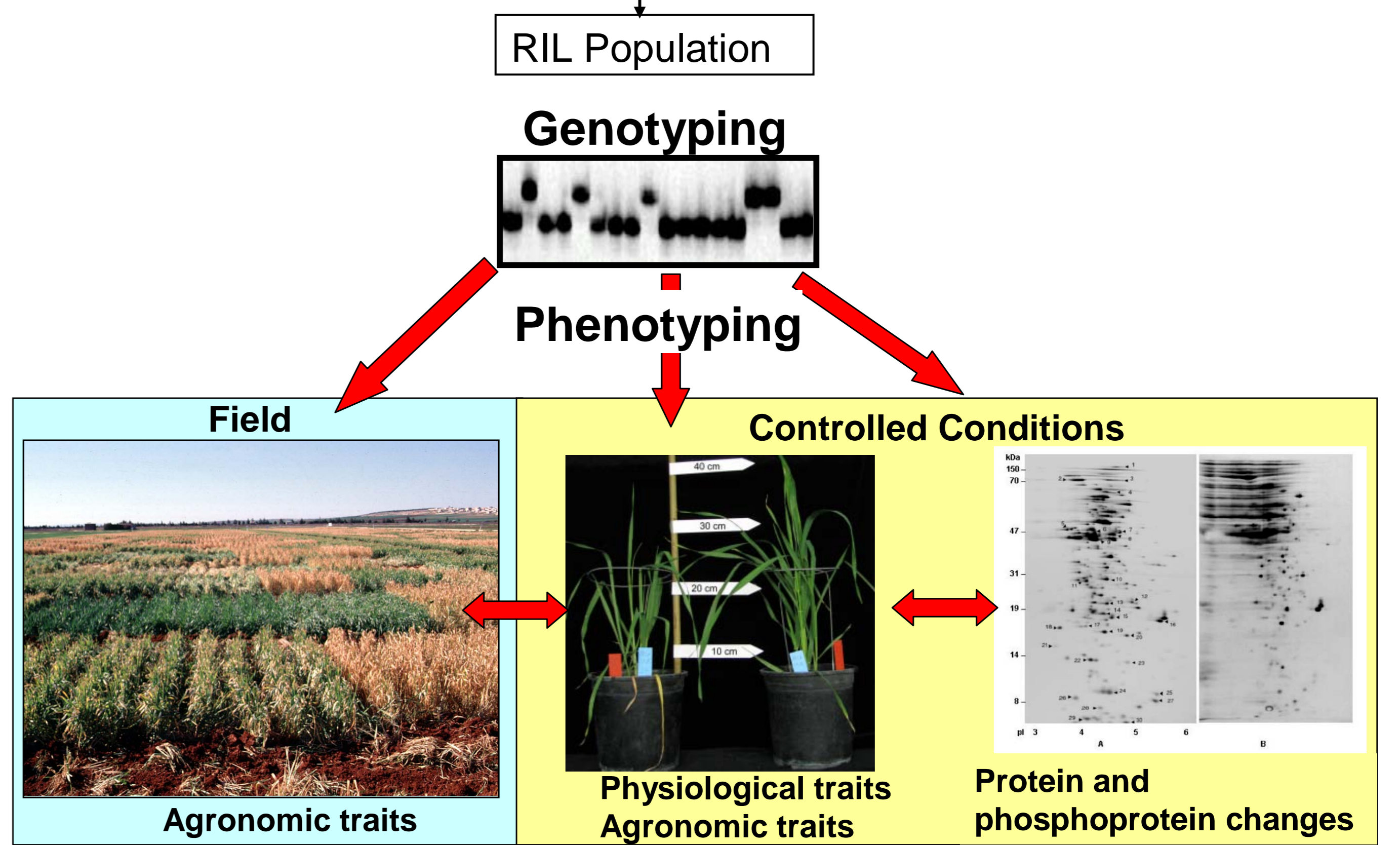
PEDEX = Peduncle extrusion
 GV = Growth vigour

Main effects across environments
 Arta increases trait value
 Keel increases trait value
 Marker * environment interaction

•Syrian Landrace, adapted to to driest sites in Syria
 •Vernalisation requirement

Arta x Keel

•Australian Feed Barley, drought tolerant
 •No vernalisation requirement

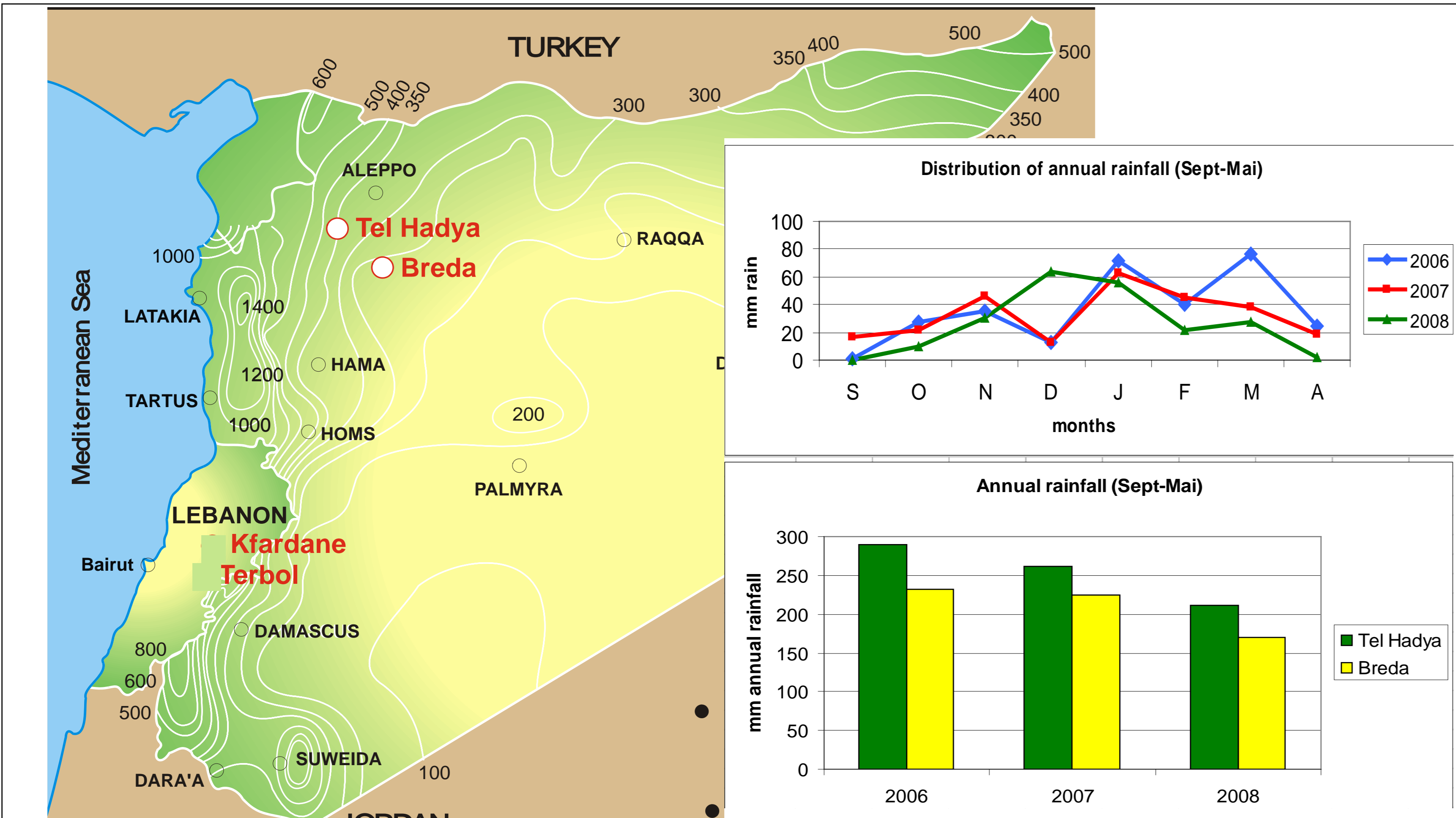


A recombinant inbred barley population derived from Arta x Keel was grown at two different field locations in Syria from 2006-2008 including additional spring plantings in 2007 and 2008 at both locations. A mixed model approach was used to detect QTL and marker by environment interactions. The population is currently tested for differences in physiological traits and protein expression under control and drought conditions in the greenhouse.

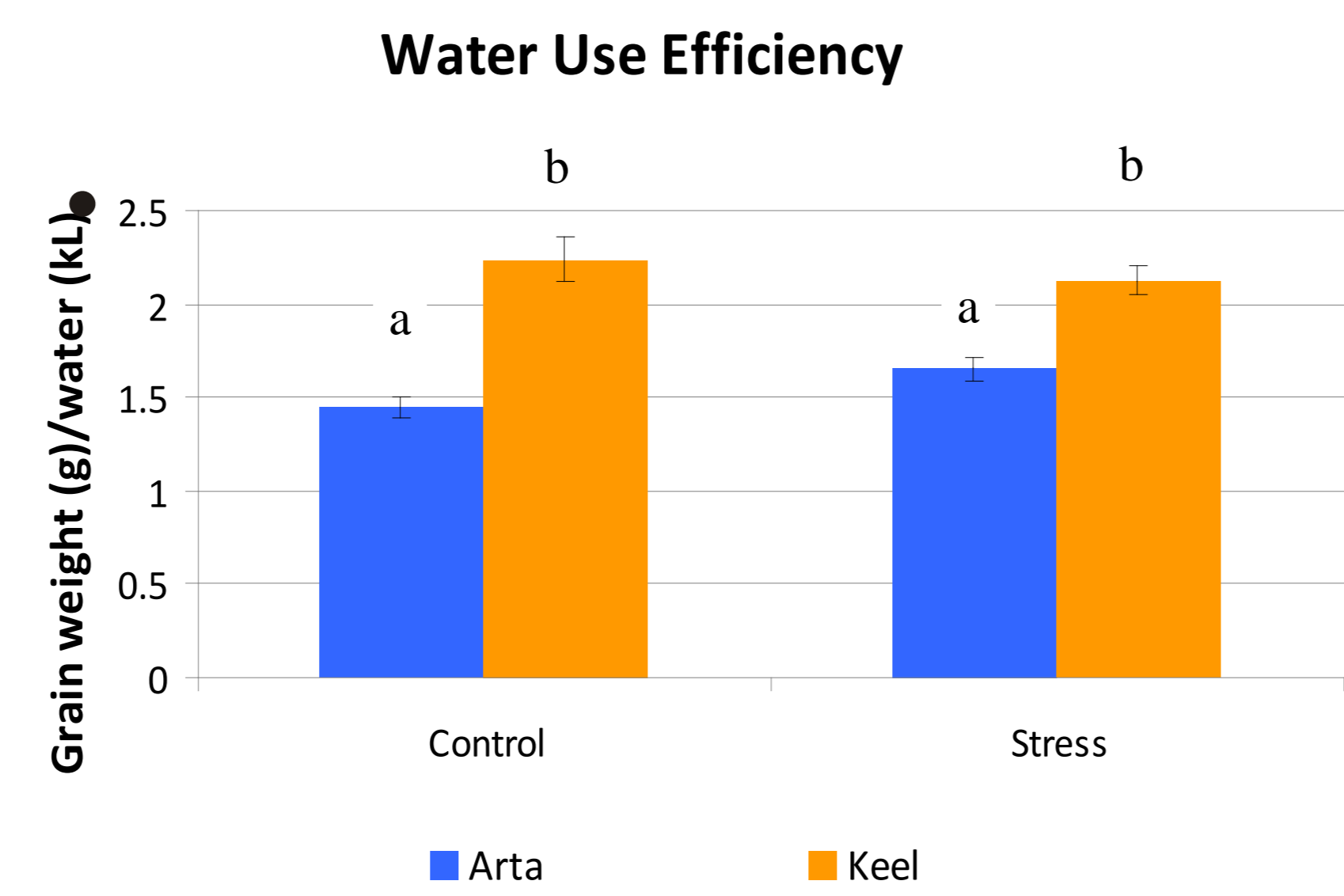
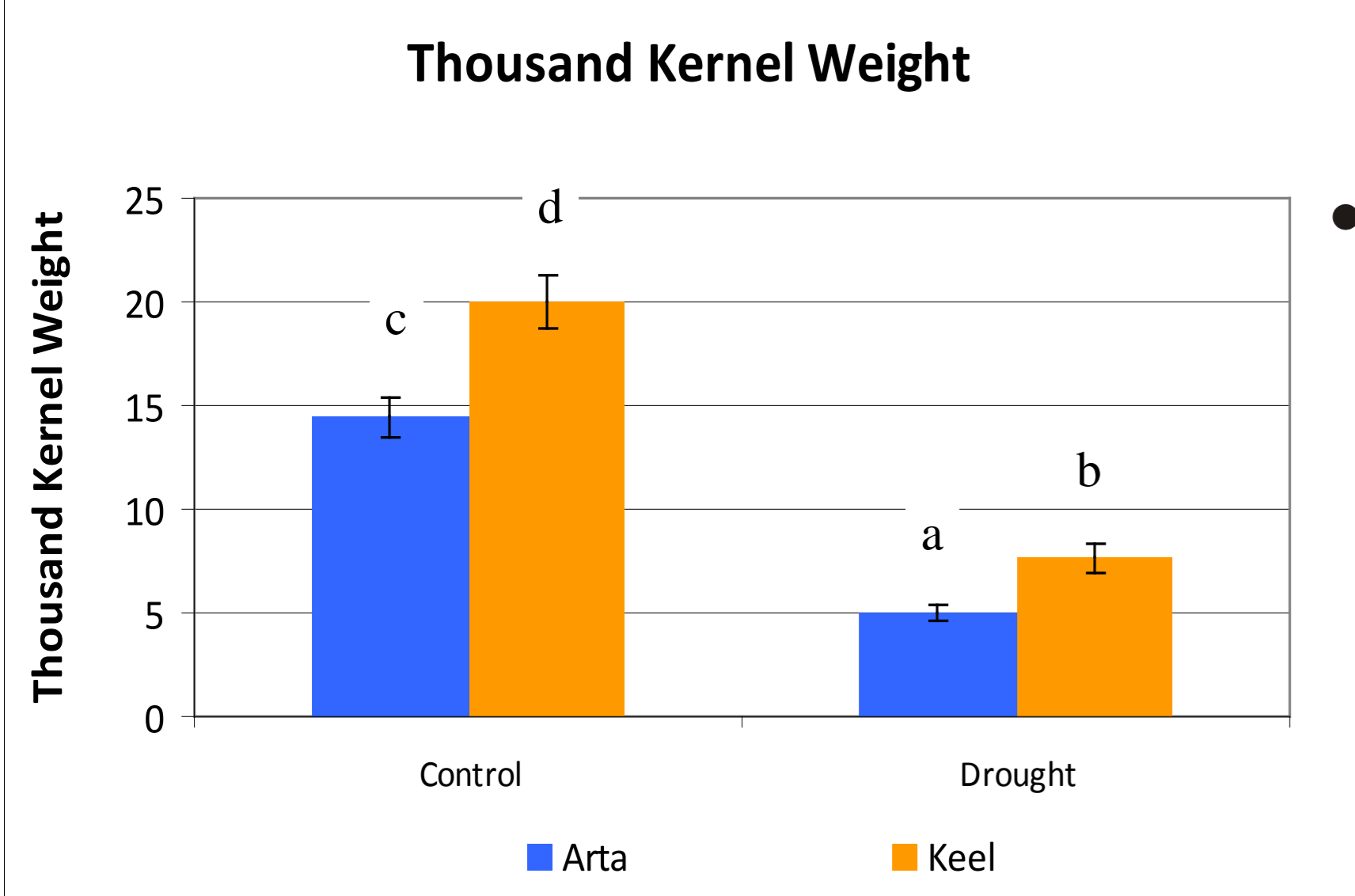
Results

The different environments analyzed showed a large variation in temperature and rainfall distribution which resulted in significant genotype by environment interactions. Developmental and morphological traits affected grain yield differently in different environments which was reflected in a number of QTL by environment interactions.

QTL main effects across all environments were only detected for plant height, peduncle length, kernel weight and growth vigor. Grain yield under drought was mainly affected by flowering time. Epistatic interactions between different parental alleles at *Vrn-H1*, *Vrn-H2* and a QTL on 7HL caused late flowering and a concomitant decline in yield.

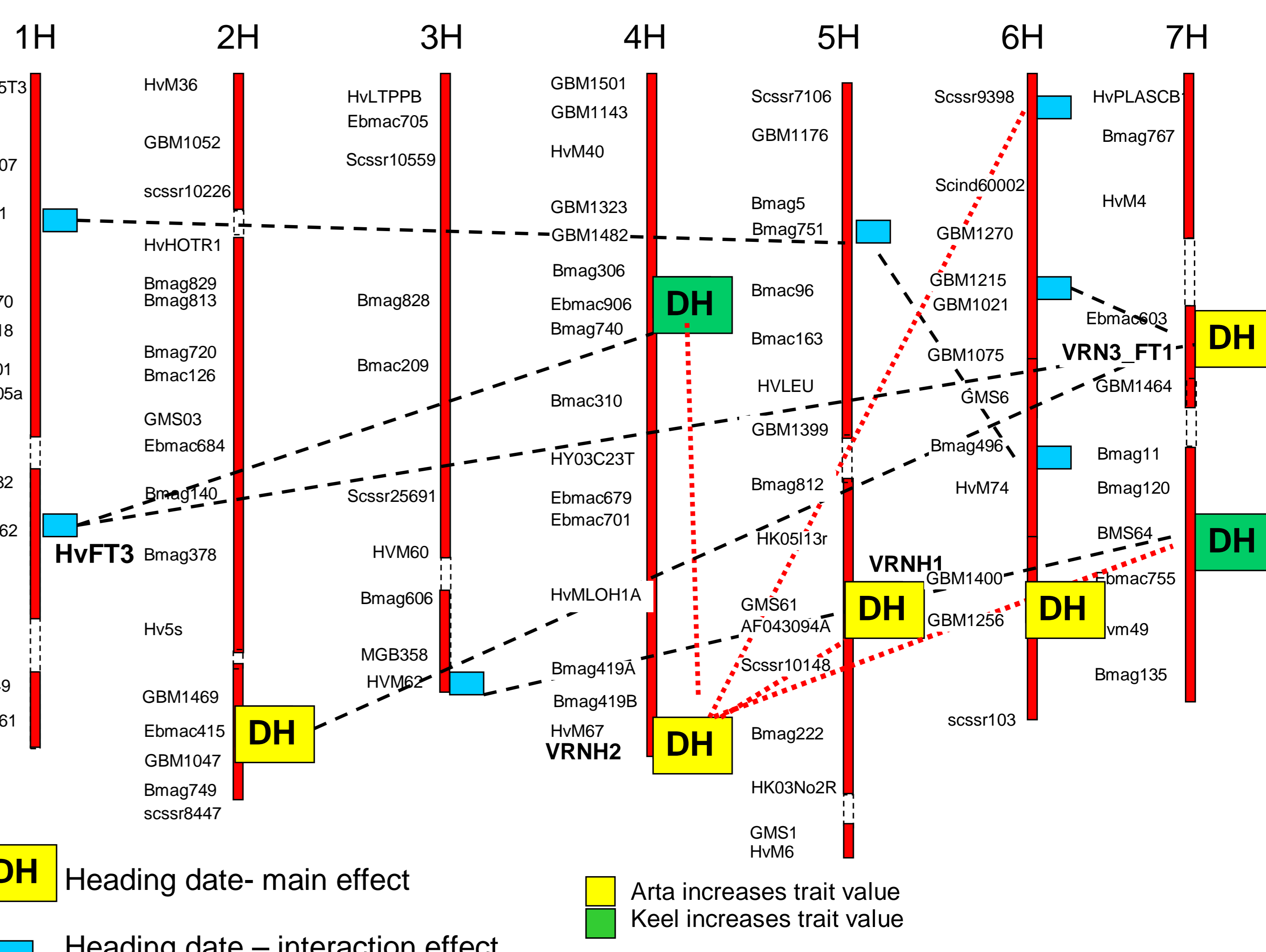


The RIL population was trialled at Tel Hadya and Breda, Syria from 2006-2008. The environments were characterised by moderate to severe drought stress. Rainfall decreased from 2006 to 2008, in particular during the major growth months February, March.



Drought reduced kernel weight in Arta and Keel, while Keel showed higher kernel weight under control and drought conditions. Keel was characterised by a higher water use efficiency than Arta.

Epistatic interactions for flowering



Analysis of epistatic interactions revealed interactions between QTLs and markers not significant in the single marker analysis. The QTL at *Vrn-H2* showed the largest number of epistatic interactions. Interactions between different parental alleles at *Vrn-H1*, *Vrn-H2* and a QTL on 7HL explained 50% of the genetic variance, caused late flowering and a concomitant decline in yield.