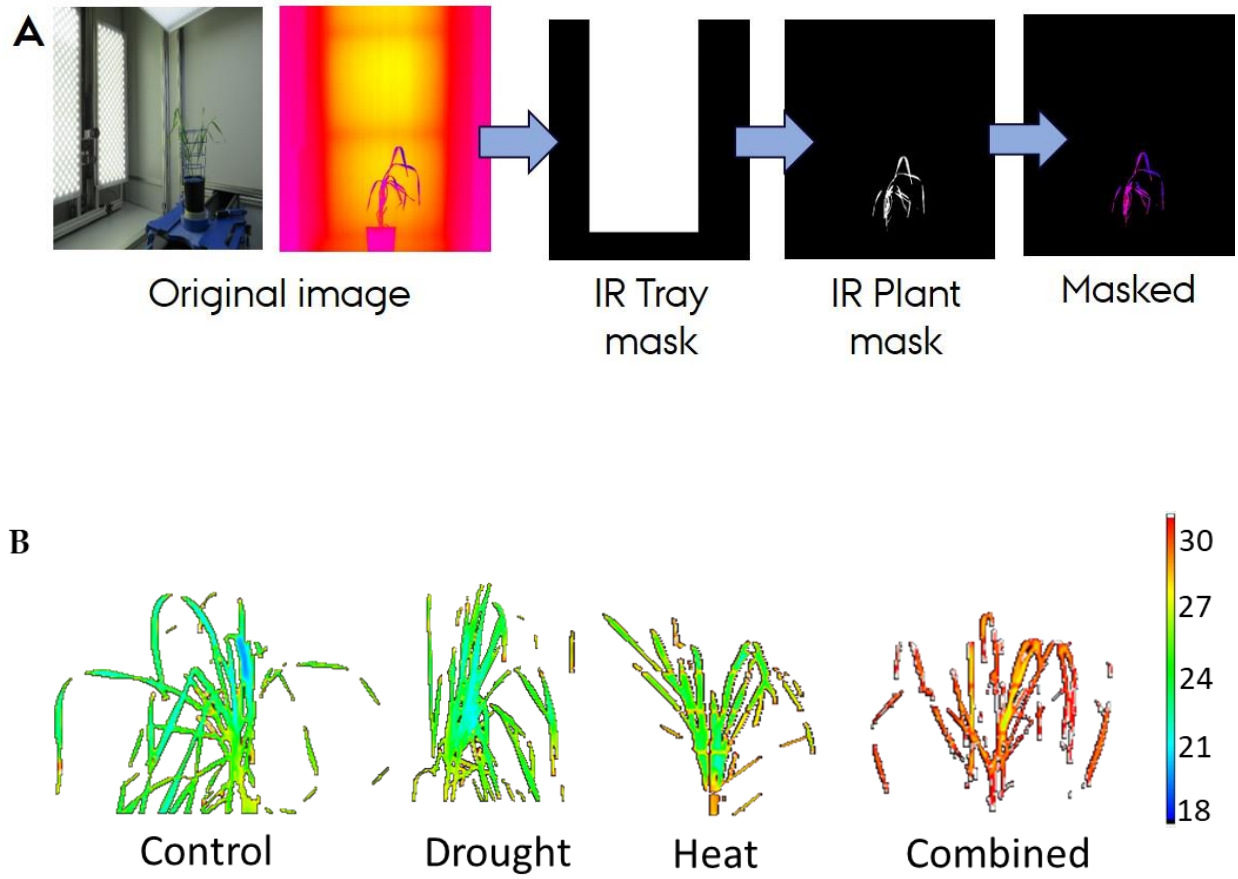

Figure S1. A Scheme of thermal infrared (IR) imaging processing. Automatic segmentation algorithm was used to subtract plant specific pixels from the background area defined by the IR tray mask and to select the IR plant mask. IR masked image was used for visualizing the plant leaf temperature. The average raw temperature of each plant (°C) was calculated after separating the background and plant surface area. **B** Selected analyzed thermal IR images at the last day of stress treatments in LM62 genotype.

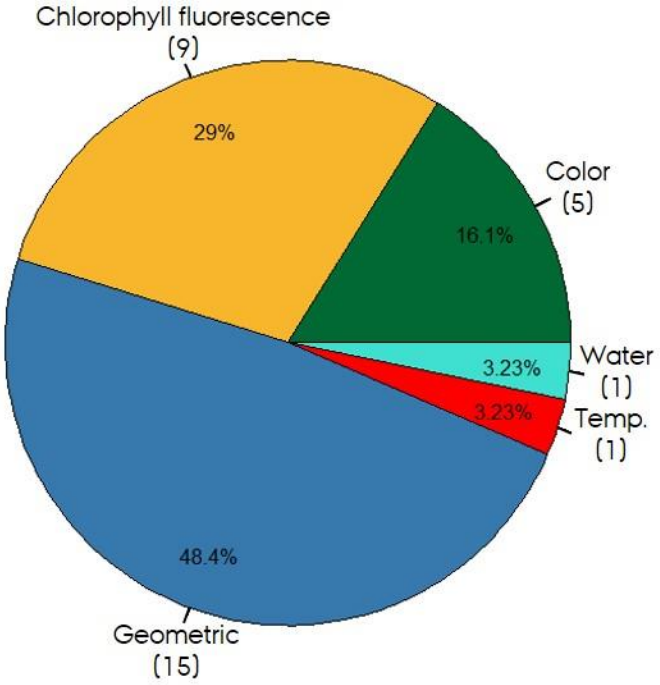

Figure S2. Classification of the measured phenotypic traits into categories as presented in Table S1. The numbers in brackets denote the numbers of parameters per category. The percentage represent the parameters in the given category.

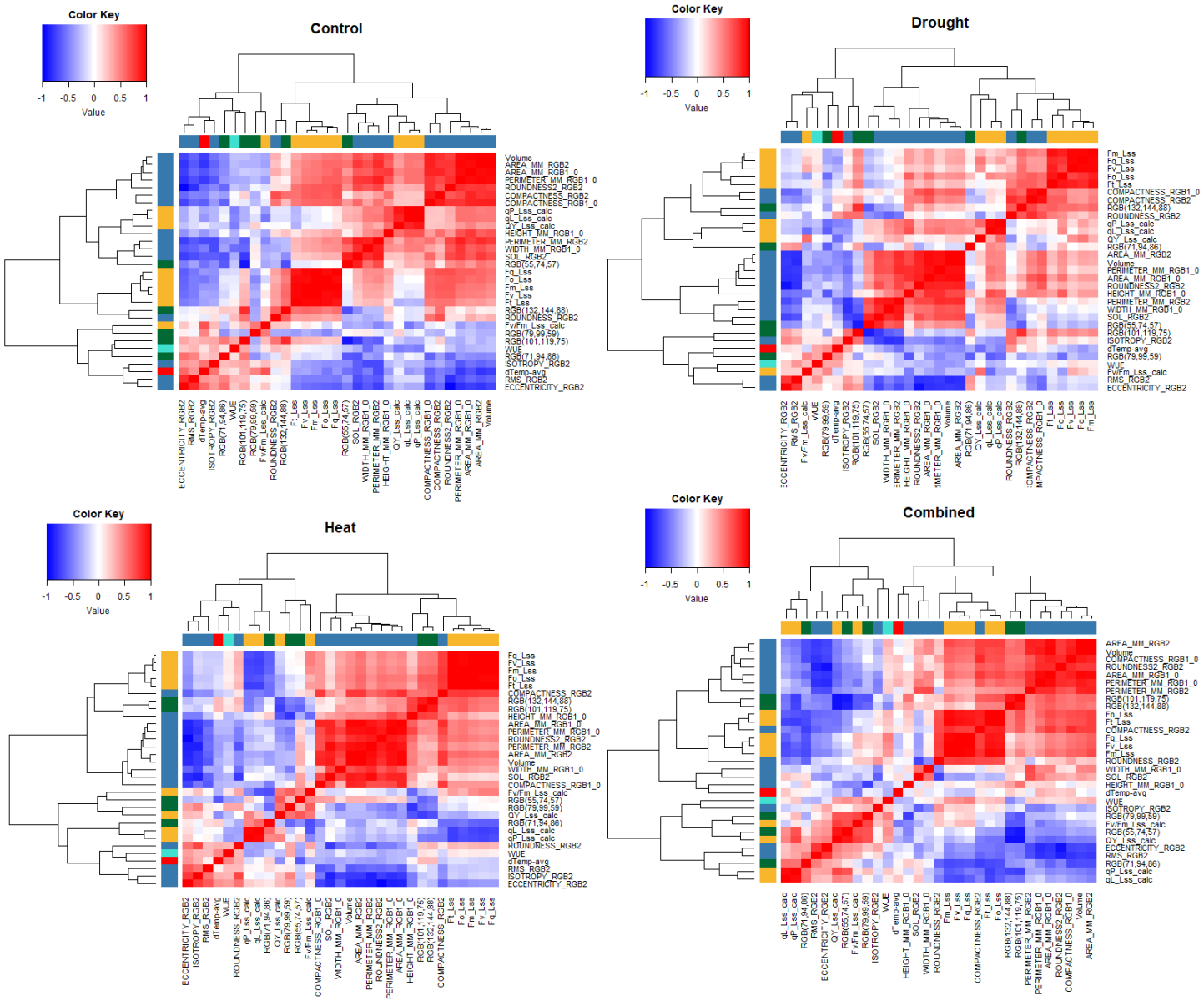

Figure S3. Trait correlation via heatmap analysis. The colors inside the box correspond to correlation coefficient (red are positive correlations and blue are negative) for all days. The colors outside the box correspond to the phenotypic trait classification according to figure S2.

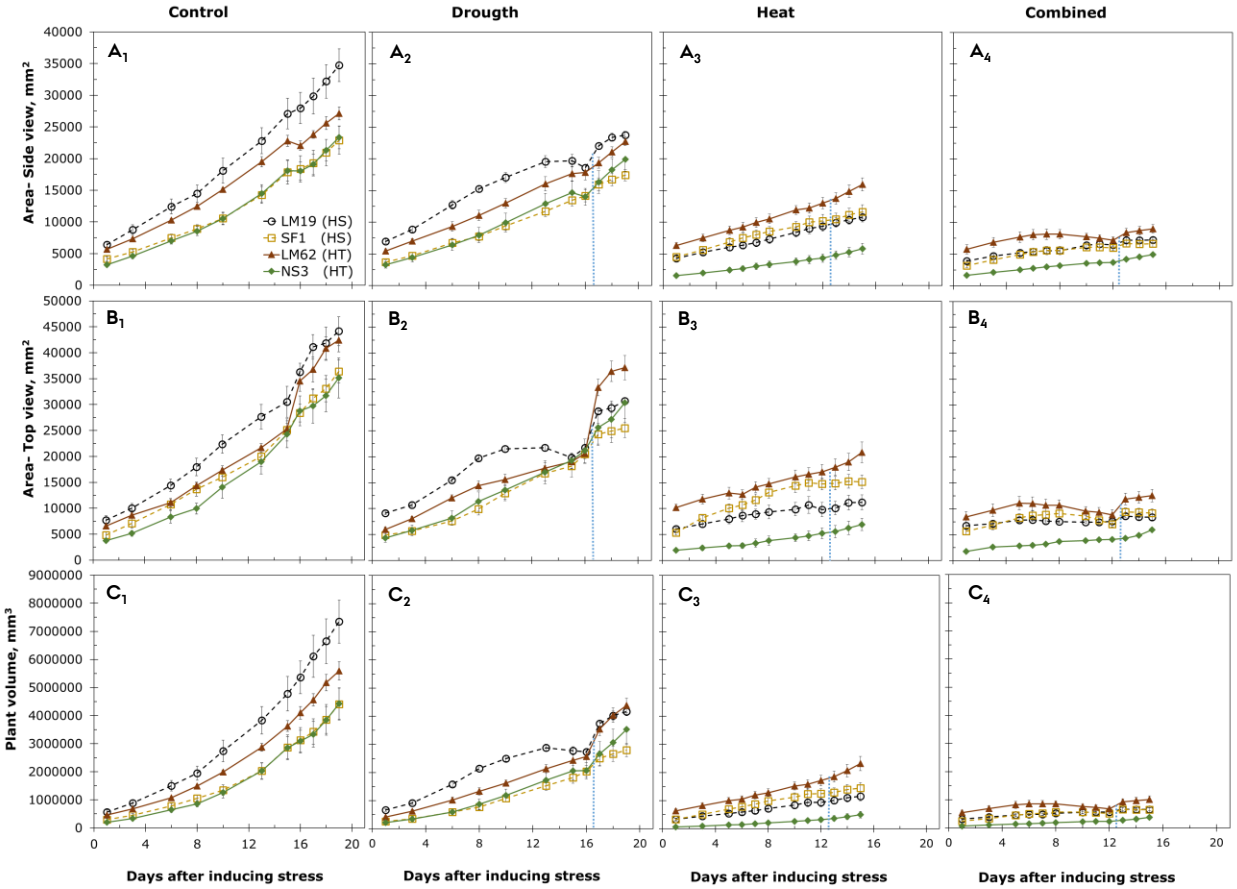

Figure S4. Analyzed side and top view RGB imaging. **A**1-4 Leaf area from RGB side view at two angles. **B**1-4 Leaf area from RGB top view. **C**1-4 Volume of plants digital biomass in day 1 before inducing the stress and along days after inducing stress treatments followed by three days of recovery in four wheat genotypes. HS represents heat sensitive genotypes (open symbols, dashed lines) and HT represents heat tolerant genotypes (closed symbols, solid lines). Blue dotted line denotes the recovery phase. The data represent mean values ± S.E.M. (n = 5).

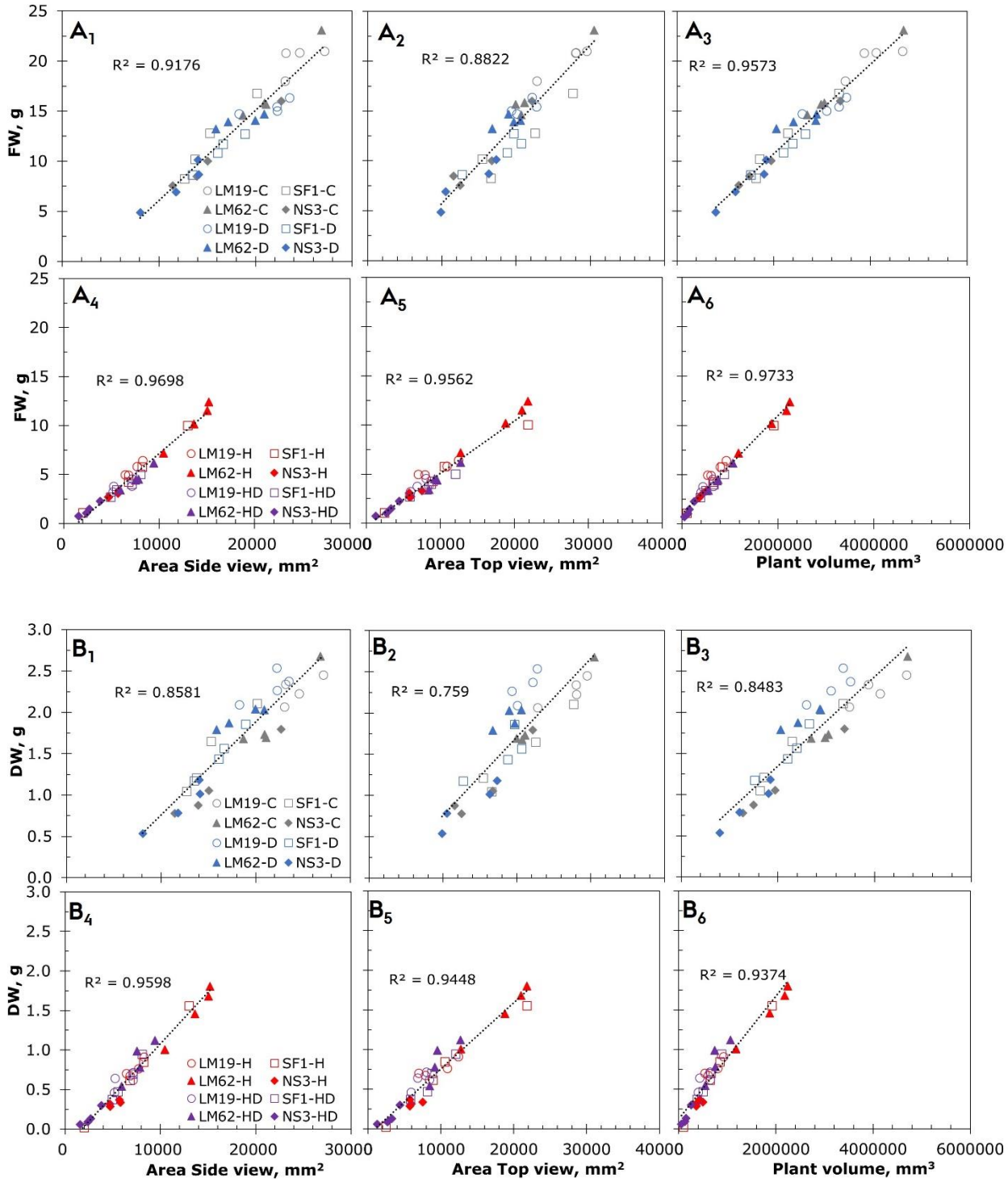

Figure S5. **A**$_{1\text{-}6}$ Correlation between fresh weight and RGB data (Leaf area from RGB side and top view image and calculated plant volume). **B**$_{1\text{-}6}$ Correlation between dry weight and RGB data (Leaf area from RGB side and top view image and calculated plant volume) at the last day of control (C: grey), drought (D: blue), heat (H: red) and combined (HD: purple) stress treatments. The data represent mean values ± S.E.M. (n = 4).

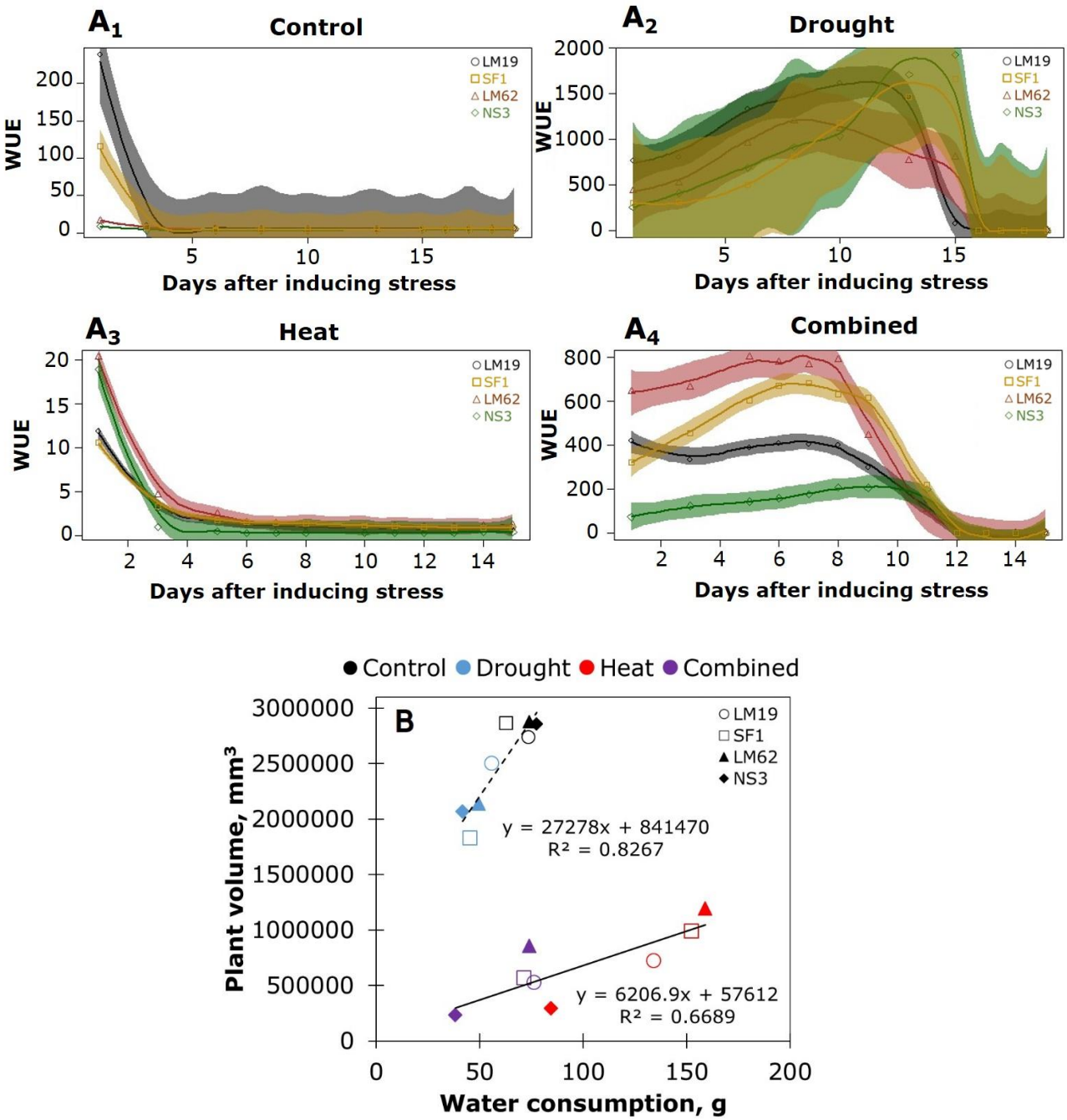

Figure S6. A1-4 Water use efficiency (WUE) trait development during the days after inducing stress for all the treatments. Solid lines represent the means and shading represents the (±) standard deviation. **B** Correlation between plant volume and water consumption at the last day of four different treatments in each wheat genotype. The symbols represent the genotypes LM19 (open circles), SF1 (open squares), LM62 (closed triangles) and NS3 (closed diamonds). The linear dashed line represents control and drought treatments and the linear solid line represents heat and combined stress treatments. R^2 values represent the level of fit for the linear regressions ($n = 4$).

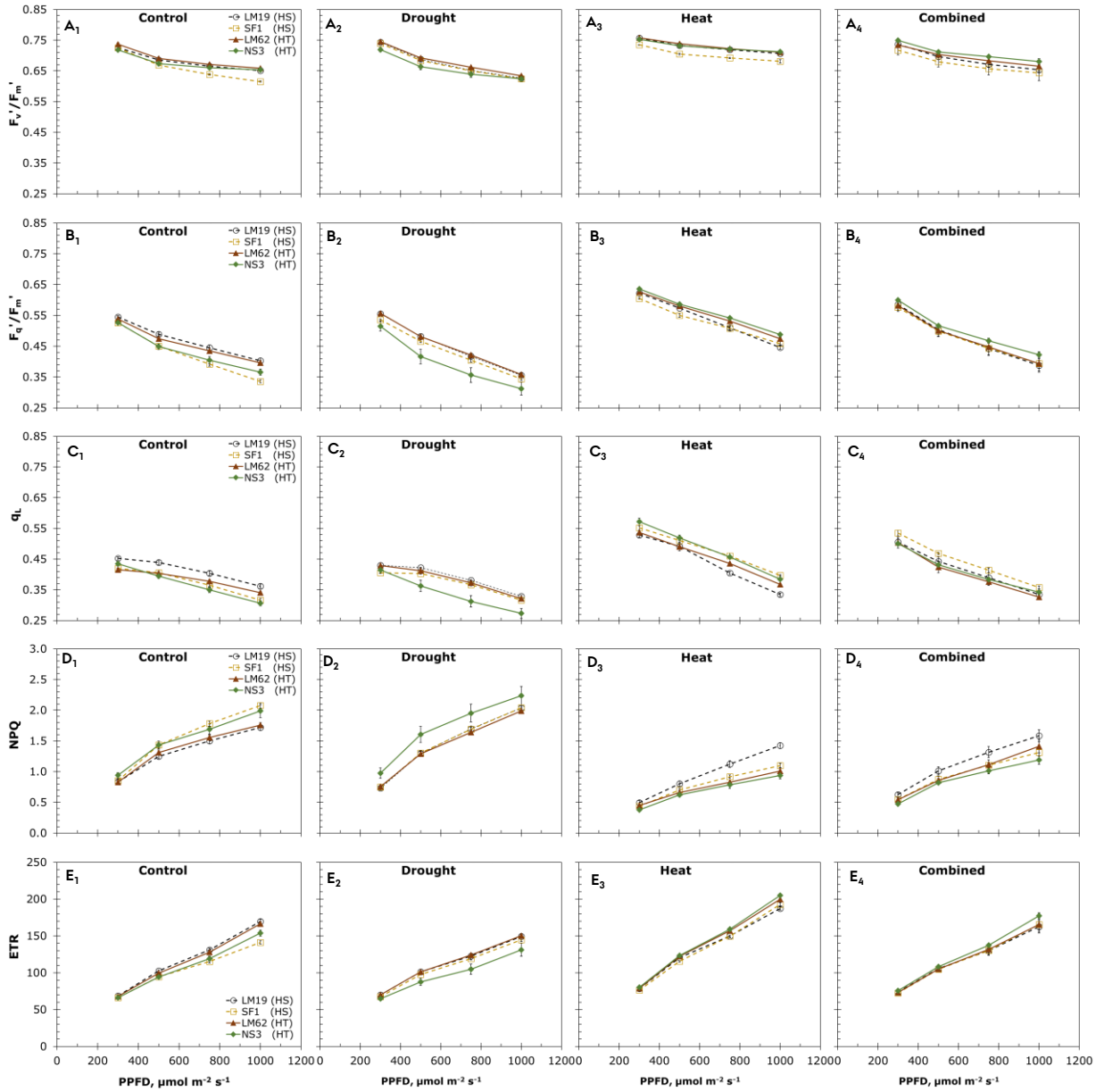

Figure S7. Light response curves after dark adaptation. **A1-4** Maximum quantum efficiency of PSII photochemistry (F_v'/F_m'). **B1-4** PSII operating efficiency (F_q'/F_m'). **C1-4** Fraction of open PSII centers (oxidized Q_A) in steady state (q_L). **D1-4** Non-photochemical quenching (NPQ). **E1-4** Electron transport rate (ETR) at last day of the stress treatments in four wheat genotypes. The data represent mean values ± S.E.M (*n* = 4 except under heat stress *n*=3).

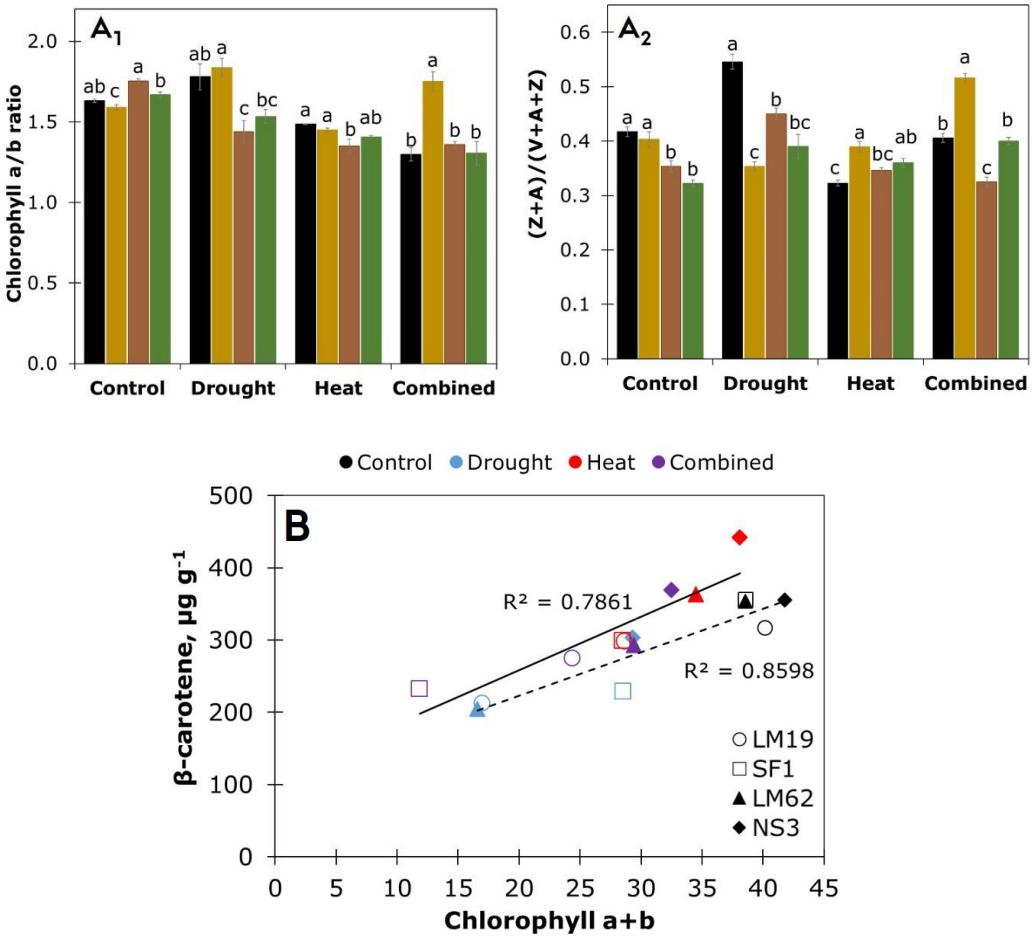

Figure S8. Leaf pigment analysis. **A**$_{1\text{-}2}$ Chlorophyll a/b ratio and the degree of de-epoxidation of xanthophyll-cycle components ((Z+A)/(V+A+Z)) where Z is zeaxanthin, A is antheraxanthin, and V is violaxanthin. **B** Correlation between β-carotene and chlorophyll a+b contents at the last day of four different treatments in each wheat genotype. The linear dashed line represents control and drought treatments and the linear solid line represents heat and combined stress treatments. R^2 values represent the level of fit for the linear regressions (n = 4).