**SUPPORTING INFORMATION LEGENDS**

**Figure S1.** MAGIC breeding design.

**Figure S2.** Variation in plant growth habit measured in the MAGIC core set and eight parents grown under full irrigation with different photoperiod conditions: (a) long-daylength at UCR-CES in 2015 and (b) short-daylength at CVARS in 2015 and 2016 (means of 2 years). Growth habit index: (1) acute erect, (2) erect, (3) semi-erect, (4) intermediate, (5) semi-prostrate, and (6) prostrate.

**Figure S3.** Variation in (a) dry grain yield and (b) seed size measured in the 305-RIL MAGIC core set and parents grown under restricted and normal irrigation regimes at CVARS in 2015 and 2016. Each dot represents a MAGIC RIL based on mean phenotypic values of two years of data. Labeled solid squares are MAGIC parents (A: IT89KD-288, B: IT84S-2049, C: CB27, D: IT82E-18, E: Suvita-2, F: IT00K-1263, G: IT84S-2246, H: IT93K-503-1).

**Data S1.** MAGIC genotypes and phenotypes.