

## SUPPLEMENTARY MATERIAL

**Table S1.** Number of accessions at different flowering times and phenological stage using Zadoks decimal code (GS) at each of the key measurement date.

| Flowering time | Number of accession | Zadoks decimal code |              |             |              |              |              |
|----------------|---------------------|---------------------|--------------|-------------|--------------|--------------|--------------|
|                |                     | 13.2.17 (GS)        | 16.2.17 (GS) | 6.3.17 (GS) | 13.3.17 (GS) | 21.3.17 (GS) | 28.3.17 (GS) |
| 0              | 1                   | 37                  | 37           | 47          | 52           | 65           | 75           |
| 7              | 1                   | 31                  | 31           | 41          | 45           | 53           | 58           |
| 8              | 2                   | 32                  | 32           | 42          | 46           | 62           | 75           |
| 10             | 79                  | 31                  | 31           | 41          | 46           | 56           | 65           |
| 12             | 12                  | 29                  | 29           | 39          | 44           | 54           | 62           |
| 13             | 3                   | 31                  | 31           | 41          | 45           | 53           | 58           |
| 14             | 12                  | 30                  | 30           | 40          | 45           | 55           | 63           |
| 15             | 10                  | 30                  | 30           | 40          | 45           | 56           | 66           |
| 16             | 3                   | 30                  | 30           | 40          | 44           | 57           | 67           |
| 17             | 69                  | 28                  | 28           | 38          | 43           | 53           | 60           |
| 25             | 26                  | 23                  | 23           | 33          | 38           | 45           | 49           |
| 35             | 30                  | 25                  | 25           | 35          | 39           | 47           | 52           |

**Table S2.** Linear regression of the relationship between the biomass at mid grain filling and the normalized difference vegetation index (NDVI), using Sequoia (SE) and RedEdge (RE) sensors, measured on different days across genotypes exhibiting different dates of anthesis: 10, 12, 13, 14, 15, 16, 17, 25, and 35 days. Level of significance, ns  $P > 0.05$  and  $P < 0.05$ .

| Flowering time           | vs. Biomass  |         |         |         |              |         |         |               |         |
|--------------------------|--------------|---------|---------|---------|--------------|---------|---------|---------------|---------|
|                          | 10 days      | 12 days | 13 days | 14 days | 15 days      | 16 days | 17 days | 25 days       | 35 days |
| NDVI (SE) 13 Feb control | 0.209        | 0.343   | 0.798   | -0.234  | 0.063        | -0.982  | 0.025   | 0.029         | 0.232   |
| <i>P</i> value           | 0.064        | 0.275   | 0.411   | 0.464   | 0.863        | 0.121   | 0.836   | 0.887         | 0.217   |
| N                        | 79           | 12      | 3       | 12      | 10           | 3       | 69      | 26            | 30      |
| NDVI (SE) 21 Feb control | <b>0.255</b> | 0.467   | 0.842   | -0.236  | 0.239        | -0.854  | 0.114   | 0.094         | 0.261   |
| <i>P</i> value           | <b>0.023</b> | 0.126   | 0.362   | 0.460   | 0.507        | 0.348   | 0.351   | 0.649         | 0.164   |
| N                        | 79           | 12      | 3       | 12      | 10           | 3       | 69      | 26            | 30      |
| NDVI (SE) 3 Mar control  | 0.111        | 0.215   | -0.625  | 0.103   | 0.139        | -0.890  | -0.095  | -0.019        | 0.290   |
| <i>P</i> value           | 0.331        | 0.502   | 0.570   | 0.751   | 0.702        | 0.301   | 0.438   | 0.925         | 0.119   |
| N                        | 79           | 12      | 3       | 12      | 10           | 3       | 69      | 26            | 30      |
| NDVI (SE) 13 Mar control | 0.173        | 0.015   | -0.995  | 0.147   | 0.331        | -0.947  | -0.082  | -0.069        | 0.335   |
| <i>P</i> value           | 0.126        | 0.962   | 0.061   | 0.649   | 0.351        | 0.209   | 0.505   | 0.737         | 0.071   |
| N                        | 79           | 12      | 3       | 12      | 10           | 3       | 69      | 26            | 30      |
| NDVI (RE) 21 Mar stress  | 0.094        | -0.056  | 0.107   | 0.182   | <b>0.654</b> | -0.926  | 0.034   | -0.233        | 0.218   |
| <i>P</i> value           | 0.409        | 0.862   | 0.932   | 0.572   | <b>0.040</b> | 0.247   | 0.783   | 0.253         | 0.248   |
| N                        | 79           | 12      | 3       | 12      | 10           | 3       | 69      | 26            | 30      |
| NDVI (SE) 21 Mar stress  | 0.195        | 0.184   | 0.085   | 0.333   | 0.456        | -0.924  | 0.102   | -0.114        | 0.261   |
| <i>P</i> value           | 0.085        | 0.567   | 0.946   | 0.290   | 0.185        | 0.250   | 0.406   | 0.580         | 0.163   |
| N                        | 79           | 12      | 3       | 12      | 10           | 3       | 69      | 26            | 30      |
| NDVI (RE) 28 Mar stress  | 0.066        | -0.054  | 0.562   | 0.087   | 0.525        | -0.575  | 0.032   | <b>-0.496</b> | 0.009   |
| <i>P</i> value           | 0.566        | 0.867   | 0.620   | 0.788   | 0.119        | 0.610   | 0.793   | <b>0.010</b>  | 0.963   |
| N                        | 79           | 12      | 3       | 12      | 10           | 3       | 69      | 26            | 30      |

**Table S3.** Linear regression of the relationship between the biomass and the stable carbon isotope composition ( $\delta^{13}\text{C}$ ) in the culm dry matter sampled before stress conditions were imposed ( $\delta^{13}\text{C}$  control, right panels) and after two weeks of the last irrigation ( $\delta^{13}\text{C}$  stress, left panels) across genotypes exhibiting the different dates of anthesis: 10, 12, 13, 14, 15, 16, 17, 25, and 35 days. Level of significance, ns  $P > 0.05$ ;  $P < 0.05$ ;  $P < 0.01$  and  $P < 0.001$ .

| Flowering time |                | $\delta^{13}\text{C}$ control | $\delta^{13}\text{C}$ stress |
|----------------|----------------|-------------------------------|------------------------------|
| 10 days        | Biomass        | <b>-0.407</b>                 | <b>-0.301</b>                |
|                | <i>P</i> value | <b>0.000</b>                  | <b>0.008</b>                 |
|                | N              | 79                            | 77                           |
| 12 days        | Biomass        | 0.219                         | <b>-0.58</b>                 |
|                | <i>P</i> value | 0.543                         | <b>0.048</b>                 |
|                | N              | 10                            | 12                           |
| 13 days        | Biomass        | -0.289                        | 0.800                        |
|                | <i>P</i> value | 0.813                         | 0.410                        |
|                | N              | 3                             | 3                            |
| 14 days        | Biomass        | 0.436                         | 0.419                        |
|                | <i>P</i> value | 0.157                         | 0.175                        |
|                | N              | 12                            | 12                           |
| 15 days        | Biomass        | <b>-0.739</b>                 | -0.348                       |
|                | <i>P</i> value | <b>0.015</b>                  | 0.325                        |
|                | N              | 10                            | 10                           |
| 16 days        | Biomass        | -0.781                        | <b>-0.997</b>                |
|                | <i>P</i> value | 0.430                         | <b>0.048</b>                 |
|                | N              | 3                             | 3                            |
| 17 days        | Biomass        | -0.222                        | <b>-0.322</b>                |
|                | <i>P</i> value | 0.076                         | <b>0.008</b>                 |
|                | N              | 65                            | 67                           |
| 25 days        | Biomass        | 0.005                         | -0.277                       |
|                | <i>P</i> value | 0.980                         | 0.170                        |
|                | N              | 26                            | 26                           |
| 35 days        | Biomass        | -0.168                        | -0.165                       |
|                | <i>P</i> value | 0.392                         | 0.383                        |
|                | N              | 28                            | 30                           |

**Figure S1.** Image of the field trial conducted at the Maricopa Agricultural Center and the open-air phenotyping robotic scanner. The plant material included 248 accessions of durum wheat representing a large portion of the genetic diversity present in the most important improved durum wheat gene pools.

