**Supplementary data**

**Manuscript Title:** Genome scan identifies flowering-independent effects of barley HsDry2.2 locus on yield traits under water deficit  
**Authors:** Lianne Merchuk-Ovnat*, Roi Silberman*, Efrat Laiba, Andreas Maurer, Klaus Pillen, Adi Faigenboim, Eyal Fridman

| Primer name | Use                  | sequence                      |
|-------------|----------------------|-------------------------------|
| PM58        | F                    | AGGTTTCCCTCGGGTTCAG           |
| PM59        | R                    | GGCAGGGTACGTCTGTCTCT          |
| PM206       | F                    | AGCTATGCGTAAAAACATGCTTGAGA   |
| PM271       | F                    | TGTAGCGCATACATGGCAA           |
| PM272       | R                    | GGTTACCAGTGGAGGTGCTC          |
| PM273       | F                    | AATGGCCACGAGTTTCTTCCC         |
| PM274       | R                    | TGTTGAACACAGCAGGAAGGT         |
| PM275       | R                    | ACATGGAGGGAGGGAGAAA          |
Supplementary data

**Manuscript Title:** Genome scan identifies flowering-independent effects of barley HsDry2.2 locus on yield traits under water deficit

**Authors:** Lianne Merchuk-Ovnat*, Roi Silberman*, Efrat Laiba, Andreas Maurer, Klaus Pillen, Adi Faigenboim, Eyal Fridman

Table S2 Traits distribution and heritability values under WW and WL environments

h2, Broad-sense heritability calculated as proportion of variance explained by genotype across two years

| Year | Trait | Units | WW N | Mean | Min | Max | STD | cv | WL N | Mean | Min | Max | STD | cv | WL/WW |
|------|-------|-------|------|------|-----|-----|-----|----|------|------|-----|-----|-----|----|-------|
| 2015 | GFP   | Days  | 1399 | 36   | 15  | 58  | 6.4 | 17.9| 1359 | 29.7 | 10  | 60  | 7   | 23.6| 0.8 |
| 2015 | GN    | #     | 1294 | 297  | 34  | 681 | 104 | 34.9| 1000 | 204.7| 3   | 710 | 135 | 66.1| 0.7 |
| 2015 | GW    | Gram  | 1292 | 66.5 | 23  | 227 | 16.1| 24.2| 995  | 37.5 | 0.2 | 125 | 18.2| 48.6| 0.6 |
| 2015 | PGY   | Gram  | 1413 | 17.8 | 0.1 | 41  | 6.3 | 35.1| 1029 | 7.5  | 0.1 | 33.4| 6.7 | 89.1| 0.4 |
| 2015 | HEA   | Days  | 1429 | 97.1 | 80  | 120 | 7.6 | 7.8 | 1407 | 96.4 | 81  | 118 | 7.6 | 7.9 | 1   |
| 2015 | HEI   | cm    | 1428 | 72.8 | 45  | 126 | 12.9| 17.7| 1424 | 63.2 | 31  | 120 | 12.8| 20.3| 0.9 |
| 2015 | HI    | %     | 1385 | 31   | 0.1 | 69  | 9.9 | 32.1| 1381 | 13.5 | 0.1 | 56.6| 15  | 111 | 0.4 |
| 2015 | MAT   | Days  | 1403 | 133  | 101 | 152 | 6.9 | 5.2 | 1383 | 125.5| 108 | 157 | 7.4 | 5.9 | 0.9 |
| 2015 | TDM   | Gram  | 1387 | 59.6 | 15  | 118 | 15  | 25.2| 1382 | 42.1 | 10  | 112 | 13.3| 31.5| 0.7 |
| 2015 | VDW   | Gram  | 1371 | 41.2 | 5.2 | 80  | 13.2| 32.1| 1372 | 36.2 | 7   | 79.9| 12.8| 35.4| 0.9 |
| 2016 | GFP   | Days  | 1280 | 33.3 | 10  | 64  | 5.4 | 16.2| 1273 | 30.1 | 15  | 64  | 6.7 | 22.4| 0.9 |
| 2016 | GN    | #     | 1156 | 300  | 26  | 730 | 93.4| 31.1| 1136 | 180  | 4   | 562 | 89.4| 49.7| 0.6 |
| 2016 | GW    | Gram  | 1147 | 46.2 | 14  | 72  | 6.0 | 13.0| 1111 | 41.9 | 3   | 92  | 7.5 | 17.8| 0.9 |
| 2016 | PGY   | Gram  | 1277 | 13.9 | 0.9 | 30  | 4.3 | 31.3| 1250 | 7.6  | 0.1 | 20.9| 3.9 | 50.9| 0.5 |
| 2016 | HEA   | Days  | 1284 | 104  | 74  | 124 | 8.3 | 8   | 1294 | 102.2| 74  | 125 | 8.7 | 8.5 | 1   |
| 2016 | HEI   | cm    | 1295 | 70.2 | 40  | 115 | 11.5| 16.4| 1291 | 59.1 | 30  | 98  | 10.9| 18.4| 0.8 |
| 2016 | HI    | %     | 1270 | 30.8 | 2.7 | 65  | 8.1 | 26.3| 1245 | 22   | 0.3 | 73.6| 10.3| 46.7| 0.7 |
| 2016 | MAT   | Days  | 1281 | 137  | 120 | 149 | 6.5 | 4.8 | 1274 | 132.2| 100 | 149 | 5.9 | 4.5 | 1   |
| 2016 | TDM   | Gram  | 1289 | 45.2 | 11  | 83  | 10  | 22  | 1287 | 34.8 | 13.6| 71.4| 9.3 | 26.7| 0.8 |
| 2016 | VDW   | Gram  | 1270 | 31.5 | 11  | 66  | 8.2 | 26  | 1243 | 27.3 | 5.7 | 58.7| 8.1 | 29.6| 0.9 |
| Year | Trait | Units | WW | | | N | Mean | Min | Max | STD | cv | h2 | WL | | N | Mean | Min | Max | STD | cv | h2 | WL/WW |
|------|-------|------|----|---|---|---|----|----|----|----|----|----|---|---|----|---|----|----|---|----|----|---|----|
| 15&16 | GFP | Days | 1296 | 36 | 19 | 61 | 4.9 | 13.6 | 0.62 | 1292 | 30.1 | 11.1 | 52.3 | 5.6 | 18.6 | 0.68 | 0.8 |
| 15&16 | GN | # | 1295 | 301 | 48 | 686 | 79.2 | 26.4 | 0.69 | 1244 | 207 | 5.7 | 583 | 96.4 | 46.5 | 0.55 | 0.7 |
| 15&16 | GW | Gram | 1453 | 66.4 | 29 | 175 | 11.2 | 16.9 | 0.71 | 1453 | 41.0 | 0 | 92 | 11.2 | 27.3 | 0.52 | 0.6 |
| 15&16 | GY | Gram | 1296 | 18.3 | 7 | 32 | 4.1 | 22.1 | 0.72 | 1283 | 7.6 | 0.1 | 24.9 | 4.1 | 53.2 | 0.55 | 0.4 |
| 15&16 | HEA | Days | 1296 | 103 | 82 | 125 | 7.5 | 7.3 | 0.6 | 1294 | 102 | 80.9 | 122 | 7.7 | 7.5 | 0.65 | 1 |
| 15&16 | HEI | cm | 1296 | 72.6 | 47 | 110 | 10.1 | 14 | 0.63 | 1295 | 63.2 | 37.6 | 101 | 9.9 | 15.7 | 0.62 | 0.9 |
| 15&16 | HI | % | 1254 | 31.6 | 7.3 | 57 | 6.8 | 21.5 | 0.75 | 1220 | 22.2 | 0.3 | 66 | 13.7 | 61.7 | 0.55 | 0.7 |
| 15&16 | MAT | Days | 1296 | 137 | 119 | 157 | 5.7 | 4.2 | 0.59 | 1292 | 132 | 121 | 153 | 5.7 | 4.3 | 0.66 | 1 |
| 15&16 | TDM | Gram | 1274 | 59.9 | 28 | 106 | 11.1 | 18.5 | 0.67 | 1265 | 42.2 | 16.7 | 79.1 | 9.4 | 22.3 | 0.63 | 0.7 |
| 15&16 | VDW | Gram | 1242 | 41.1 | 14 | 79 | 9.7 | 23.6 | 0.62 | 1212 | 36.2 | 14.8 | 66.1 | 9.1 | 25.1 | 0.59 | 0.9 |

**Supplementary data**

**Manuscript Title:** Genome scan identifies flowering-independent effects of barley HsDry2.2 locus on yield traits under water deficit

**Authors:** Lianne Merchuk-Ovnat*, Roi Silberman*, Efrat Laiba, Andreas Maurer, Klaus Pillen, Adi Faigenboim, Eyal Fridman
| WW/WL | Variable | by | Variable | Correlation | Count | Lower 95% | Upper 95% | Signif Prob |
|-------|----------|----|----------|-------------|-------|----------|----------|-------------|
| WL    | GN       | GFP |          | 0.2435      | 1242  | 0.1905   | 0.2952   | <.0001      |
| WL    | GW       | GN  |          | 0.0412      | 1241  | -0.0145  | 0.0966   | 0.1469      |
| WL    | GW       | GN  |          | 0.0461      | 1243  | -0.0095  | 0.1015   | 0.104       |
| WL    | PGY      | GFP |          | 0.2548      | 1281  | 0.2029   | 0.3053   | <.0001      |
| WL    | PGY      | GN  |          | 0.814       | 1240  | 0.7943   | 0.8319   | <.0001      |
| WL    | HEA      | GFP |          | -0.6681     | 1292  | -0.6972  | -0.6368  | <.0001      |
| WL    | HEA      | GN  |          | -0.2287     | 1244  | -0.2807  | -0.1754  | <.0001      |
| WL    | HEA      | GW  |          | -0.0694     | 1243  | -0.1245  | -0.0138  | 0.0144      |
| WL    | HEA      | PGY |          | -0.2349     | 1283  | -0.2859  | -0.1825  | <.0001      |
| WL    | HEI      | GFP |          | 0.1117      | 1232  | 0.0562   | 0.1665   | <.0001      |
| WL    | HEI      | GN  |          | 0.0613      | 1187  | 0.0044   | 0.1178   | 0.0347      |
| WL    | HEI      | GW  |          | 0.0452      | 1186  | -0.0118  | 0.1018   | 0.12        |
| WL    | HEI      | PGY |          | 0.0748      | 1223  | 0.0188   | 0.1303   | 0.0089      |
| WL    | HEI      | HEA |          | -0.1346     | 1234  | -0.1889  | -0.0794  | <.0001      |
| WL    | HI       | GFP |          | 0.1575      | 1220  | 0.1022   | 0.2117   | <.0001      |
| WL    | HI       | GN  |          | 0.5542      | 1181  | 0.5134   | 0.5925   | <.0001      |
| WL    | HI       | GW  |          | 0.3901      | 1181  | 0.3406   | 0.4374   | <.0001      |
| WL    | HI       | PGY |          | 0.7315      | 1220  | 0.7043   | 0.7565   | <.0001      |
| WL    | HI       | HEA |          | -0.193      | 1220  | -0.2465  | -0.1384  | <.0001      |
| WL    | HI       | HEI |          | -0.0033     | 1160  | -0.0608  | 0.0543   | 0.9107      |
| WL    | MAT      | GFP |          | 0.1178      | 1292  | 0.0636   | 0.1712   | <.0001      |
| WL    | MAT      | GN  |          | -0.0346     | 1242  | -0.09    | 0.0211   | 0.2235      |
| WL    | MAT      | GW  |          | -0.0728     | 1241  | -0.1279  | -0.0172  | 0.0103      |
| WL    | MAT      | PGY |          | -0.0344     | 1281  | -0.089   | 0.0204   | 0.2188      |
| WL    | MAT      | HEA |          | 0.6225      | 1292  | 0.5879   | 0.6548   | <.0001      |
| WL    | MAT      | HEI |          | -0.0639     | 1232  | -0.1194  | -0.0081  | 0.0248      |
| WL    | MAT      | HI  |          | -0.0778     | 1220  | -0.1334  | -0.0218  | 0.0065      |
| WL    | TDM      | GFP |          | 0.1029      | 1265  | 0.0481   | 0.1572   | 0.0002      |
| WL    | TDM      | GN  |          | 0.3432      | 1218  | 0.2927   | 0.3919   | <.0001      |
| WL    | TDM      | GW  |          | 0.0833      | 1217  | 0.0272   | 0.1388   | 0.0036      |
| WL    | TDM      | PGY |          | 0.3352      | 1255  | 0.2852   | 0.3835   | <.0001      |
| WL    | TDM      | HEA |          | -0.0609     | 1265  | -0.1157  | -0.0058  | 0.0302      |
| WL    | TDM      | HEI |          | 0.1832      | 1205  | 0.1281   | 0.2372   | <.0001      |
| WL    | TDM      | HI  |          | -0.0689     | 1220  | -0.1245  | -0.0128  | 0.0161      |
| WL    | TDM      | MAT |          | 0.0179      | 1265  | -0.0372  | 0.073    | 0.5245      |
| WL    | VDW      | GFP |          | 0.0016      | 1212  | -0.0548  | 0.0579   | 0.9569      |
| WL    | VDW      | GN  |          | 0.0189      | 1173  | -0.0384  | 0.0761   | 0.5179      |
| WL    | VDW      | GW  |          | -0.0814     | 1173  | -0.138   | -0.0242  | 0.0053      |
| WL    | VDW      | PGY |          | -0.054      | 1212  | -0.11    | 0.0023   | 0.0601      |
| WL    | VDW      | HEA |          | 0.0531      | 1212  | -0.0032  | 0.1091   | 0.0647      |
| WL    | VDW      | HEI |          | 0.158       | 1152  | 0.1012   | 0.2138   | <.0001      |
| WL    | VDW      | HI  |          | -0.4759     | 1212  | -0.5183  | -0.4311  | <.0001      |
| WL    | VDW      | MAT |          | 0.0603      | 1212  | 0.004    | 0.1162   | 0.0357      |
| WL    | VDW      | TDM |          | 0.8927      | 1212  | 0.8807   | 0.9036   | <.0001      |
| WW/WL | Variable | Variable | Correlation | Count | Lower 95% | Upper 95% | Signif Prob |
|-------|----------|----------|-------------|-------|-----------|-----------|-------------|
| WW    | GN       | GFP      | -0.1048     | 1295  | -0.1583   | -0.0506   | 0.0002      |
| WW    | GW       | GFP      | 0.1147      | 1295  | 0.0606    | 0.1682    | <.0001      |
| WW    | GW       | GN       | -0.4408     | 1295  | -0.4837   | -0.3958   | <.0001      |
| WW    | PGY      | GFP      | -0.0402     | 1296  | -0.0944   | 0.0143    | 0.1483      |
| WW    | PGY      | GN       | 0.8115      | 1295  | 0.792     | 0.8293    | <.0001      |
| WW    | PGY      | GW       | -0.0132     | 1295  | -0.0676   | 0.0413    | 0.635       |
| WW    | HEA      | GFP      | -0.6285     | 1296  | -0.6604   | -0.5944   | <.0001      |
| WW    | HEA      | GN       | 0.096       | 1295  | 0.0417    | 0.1497    | 0.0005      |
| WW    | HEA      | GW       | -0.0236     | 1295  | -0.078    | 0.0309    | 0.3964      |
| WW    | HEA      | PGY      | 0.0855      | 1296  | 0.0312    | 0.1393    | 0.0021      |
| WW    | HEI      | GFP      | 0.1705      | 1296  | 0.1172    | 0.2229    | <.0001      |
| WW    | HEI      | GN       | -0.0664     | 1295  | -0.1204   | -0.0119   | 0.0169      |
| WW    | HEI      | GW       | 0.0929      | 1295  | 0.0386    | 0.1466    | 0.0008      |
| WW    | HEI      | PGY      | -0.0286     | 1296  | -0.0829   | 0.0259    | 0.3036      |
| WW    | HEI      | HEA      | -0.2141     | 1296  | -0.2655   | -0.1616   | <.0001      |
| WW    | HI       | GFP      | -0.0059     | 1254  | -0.0612   | 0.0495    | 0.8357      |
| WW    | HI       | GN       | 0.4846      | 1253  | 0.4411    | 0.5259    | <.0001      |
| WW    | HI       | GW       | 0.0729      | 1253  | 0.0176    | 0.1277    | 0.0099      |
| WW    | HI       | PGY      | 0.6407      | 1254  | 0.6069    | 0.6722    | <.0001      |
| WW    | HI       | HEA      | -0.035      | 1254  | -0.0902   | 0.0204    | 0.2152      |
| WW    | HI       | HEI      | -0.2163     | 1254  | -0.2685   | -0.1629   | <.0001      |
| WW    | MAT      | GFP      | 0.0259      | 1296  | -0.0286   | 0.0802    | 0.3521      |
| WW    | MAT      | GN       | 0.0451      | 1295  | -0.0094   | 0.0993    | 0.1049      |
| WW    | MAT      | GW       | 0.058       | 1295  | 0.0035    | 0.1121    | 0.0369      |
| WW    | MAT      | PGY      | 0.0846      | 1296  | 0.0303    | 0.1384    | 0.0023      |
| WW    | MAT      | HEA      | 0.7502      | 1296  | 0.7254    | 0.7731    | <.0001      |
| WW    | MAT      | HEI      | -0.1361     | 1296  | -0.1892   | -0.0823   | <.0001      |
| WW    | MAT      | HI       | -0.0456     | 1254  | -0.1008   | 0.0097    | 0.1061      |
| WW    | TDM      | GFP      | -0.0385     | 1274  | -0.0932   | 0.0165    | 0.1699      |
| WW    | TDM      | GN       | 0.3762      | 1273  | 0.328     | 0.4224    | <.0001      |
| WW    | TDM      | GW       | -0.093      | 1273  | -0.1472   | -0.0382   | 0.0009      |
| WW    | TDM      | PGY      | 0.4036      | 1274  | 0.3566    | 0.4486    | <.0001      |
| WW    | TDM      | HEA      | 0.1491      | 1274  | 0.095     | 0.2024    | <.0001      |
| WW    | TDM      | HEI      | 0.2318      | 1274  | 0.1791    | 0.2831    | <.0001      |
| WW    | TDM      | HI       | -0.4054     | 1254  | -0.4506   | -0.3581   | <.0001      |
| WW    | TDM      | MAT      | 0.1552      | 1274  | 0.1012    | 0.2084    | <.0001      |
| WW    | VDW      | GFP      | -0.0353     | 1242  | -0.0907   | 0.0204    | 0.2141      |
| WW    | VDW      | GN       | 0.0846      | 1241  | 0.0291    | 0.1396    | 0.0029      |
| WW    | VDW      | GW       | -0.1109     | 1241  | -0.1656   | -0.0556   | <.0001      |
| WW    | VDW      | PGY      | 0.0489      | 1242  | -0.0067   | 0.1042    | 0.085       |
| WW    | VDW      | HEA      | 0.1313      | 1242  | 0.0762    | 0.1855    | <.0001      |
| WW    | VDW      | HEI      | 0.2557      | 1242  | 0.203     | 0.307     | <.0001      |
| WW    | VDW      | HI       | -0.7027     | 1242  | -0.7298   | -0.6733   | <.0001      |
| WW    | VDW      | MAT      | 0.1363      | 1242  | 0.0813    | 0.1905    | <.0001      |
| WW    | VDW      | TDM      | 0.9258      | 1242  | 0.9174    | 0.9334    | <.0001      |
Table S4 GWAS results for trait per se. The effect correspond to the percent difference between mean phenotypic value of homozygous for the wild allele compared to carriers of the cultivated Barke allele within the whole HEB-25 population.

| Marker         | Env | Trait | chr | CM     | lod     | effect |
|----------------|-----|-------|-----|--------|---------|--------|
| SCRI_RS_197263| WL  | MAT   | 1H  | 88.9   | 5.74E+00| 1.7    |
| BOPA1_4962_1295| WL  | VDW   | 1H  | 100    | 5.45E+00| -8.7   |
| SCRI_RS_216088| WL  | GFP   | 1H  | 122.2  | 7.62E+00| 7.8    |
| SCRI_RS_153896| WL  | HEA   | 1H  | 132.4  | 9.75E+00| -3.6   |
| BOPA2_12_30871| WL  | MAT   | 2H  | 20     | 1.66E+01| 2.7    |
| BK_14          | WL  | GN    | 2H  | 20     | 7.87E+00| -19.7  |
| BK_15          | WL  | GFP   | 2H  | 20     | 1.55E+01| -10.12 |
| BK_15          | WL  | HEA   | 2H  | 20     | 3.69E+01| 6.77   |
| SCRI_RS_155067| WL  | TDM   | 2H  | 57.4   | 6.19E+00| -6.8   |
| SCRI_RS_196026| WL  | GFP   | 2H  | 57.4   | 4.09E+00| 17.6   |
| SCRI_RS_196026| WL  | VDW   | 2H  | 57.4   | 1.00E+01| -10    |
| SCRI_RS_235063| WL  | HEA   | 2H  | 57.4   | 5.78E+00| -7.7   |
| SCRI_RS_12492 | WL  | HI    | 2H  | 57.4   | 5.29E+00| 26.58  |
| BOPA1_ABC08774_1_1_752 | WL  | MAT   | 2H  | 57.4   | 1.44E+01| -2.12  |
| SCRI_RS_199987| WL  | TDM   | 3H  | 40.7   | 2.57E+01| 17.4   |
| SCRI_RS_199987| WL  | VDW   | 3H  | 40.7   | 2.45E+01| 20     |
| SCRI_RS_151711| WL  | MAT   | 3H  | 103.8  | 6.17E+00| -2.1   |
| SCRI_RS_120973| WL  | GFP   | 3H  | 108    | 9.88E+00| 9.06   |
| SCRI_RS_120973| WL  | HEA   | 3H  | 108    | 1.83E+01| -4.5   |
| SCRI_RS_103215| WL  | HEI   | 3H  | 109.2  | 9.89E+00| 21     |
| SCRI_RS_103215| WL  | TDM   | 3H  | 109.2  | 6.60E+00| 6.9    |
| SCRI_RS_103215| WL  | VDW   | 3H  | 109.2  | 8.36E+00| 9.8    |
| SCRI_RS_194316| WL  | GFP   | 4H  | 51.4   | 7.72E+00| 19     |
| SCRI_RS_13766 | WL  | MAT   | 5H  | 106    | 2.00E+01| 2.9    |
| SCRI_RS_239128| WL  | HEA   | 5H  | 115.3  | 2.97E+01| 5.58   |
| SCRI_RS_189371| WL  | GFP   | 5H  | 118    | 8.07E+00| -6.7   |
| SCRI_RS_138461| WL  | GFP   | 7H  | 29.8   | 6.88E+00| -7.1   |
| BOPA2_12_30894| WL  | HEA   | 7H  | 34.2   | 2.18E+01| 5.7    |
| BOPA2_12_30894| WL  | MAT   | 7H  | 34.2   | 1.46E+01| 2.8    |
| BOPA1_5772_1176| WW  | GN    | 1H  | 72.6   | 7.37E+00| -12    |
| BOPA1_5772_1176| WW  | PGY   | 1H  | 72.6   | 4.75E+00| -8     |
| BOPA2_12_31319| WW  | GW    | 1H  | 92.4   | 7.29E+00| 8.6    |
| Sample Name          | Region | Time  | PH  | Value  | pH    |
|---------------------|--------|-------|-----|--------|-------|
| BOPA1_5336_400      | WW     | VDW   | 1H  | 100    | 4.68E+00 | -7.5  |
| SCRi_RS_106754      | WW     | TDM   | 1H  | 100    | 6.14E+00 | -6.5  |
| BOPA1_ABC05061_1_1_159 | WW   | HEA   | 1H  | 128    | 8.58E+00 | -3.4  |
| SCRi_RS_153896      | WW     | MAT   | 1H  | 132.4  | 8.16E+00 | -1.8   |
| BOPA1_3692_940      | WW     | GW    | 2H  | 2      | 7.67E+00 | 16.3  |
| BK_15               | WW     | GFP   | 2H  | 20     | 8.64E+00 | -5.16  |
| BK_15               | WW     | HEA   | 2H  | 20     | 3.87E+01 | 6.71   |
| BK_15               | WW     | MAT   | 2H  | 20     | 3.16E+01 | 3.6    |
| SCRi_RS_167882      | WW     | TDM   | 2H  | 57.4   | 2.12E+01 | -11.6  |
| SCRi_RS_222769      | WW     | HI    | 2H  | 57.4   | 7.79E+00 | 6.14   |
| SCRi_RS_222769      | WW     | MAT   | 2H  | 57.4   | 2.29E+01 | -2.6   |
| SCRi_RS_222769      | WW     | VDW   | 2H  | 57.4   | 1.94E+01 | -12.9  |
| SCRi_RS_235063      | WW     | GFP   | 2H  | 57.4   | 2.91E+01 | 11.5   |
| SCRi_RS_235063      | WW     | HEA   | 2H  | 57.4   | 5.38E+01 | -7.3   |
| SCRi_RS_154973      | WW     | PGY   | 3H  | 40.7   | 5.37E+00 | -9.2   |
| BOPA2_12_31475      | WW     | HI    | 3H  | 44.8   | 3.19E+01 | -18.9  |
| SCRi_RS_196189      | WW     | TDM   | 3H  | 51.6   | 1.89E+01 | 11     |
| SCRi_RS_196189      | WW     | VDW   | 3H  | 51.6   | 2.91E+01 | 19.4   |
| SCRi_RS_171144      | WW     | TDM   | 3H  | 105    | 6.61E+00 | 10.54  |
| BOPA1_ABC13753_1_2_167 | WW | GN    | 3H  | 105    | 7.14E+00 | -10.01 |
| BOPA1_6069_304      | WW     | PGY   | 3H  | 108    | 1.13E+01 | -10.5  |
| SCRi_RS_138723      | WW     | MAT   | 3H  | 108    | 1.17E+01 | -2     |
| SCRi_RS_120973      | WW     | HEA   | 3H  | 108    | 2.10E+01 | -4.8   |
| SCRi_RS_103215      | WW     | GFP   | 3H  | 109.2  | 1.09E+01 | 7.2    |
| SCRi_RS_103215      | WW     | HEI   | 3H  | 109.2  | 1.26E+02 | 21     |
| SCRi_RS_103215      | WW     | HI    | 3H  | 109.2  | 2.63E+01 | -15.2  |
| SCRi_RS_103215      | WW     | VDW   | 3H  | 109.2  | 1.22E+01 | 12.3   |
| BOPA1_3127_273      | WW     | HI    | 4H  | 54.8   | 4.93E+00 | 6.18   |
| BOPA2_12_31385      | WW     | GN    | 4H  | 60     | 6.02E+00 | 11.9   |
| BOPA1_41_695        | WW     | TDM   | 4H  | 100.6  | 5.67E+00 | 6.66   |
| BOPA1_4771_380      | WW     | GW    | 5H  | 95     | 7.20E+00 | -3.5   |
| SCRi_RS_236583      | WW     | HEA   | 5H  | 115.3  | 3.01E+01 | 5.3    |
| SCRi_RS_232705      | WW     | GFP   | 5H  | 118    | 1.05E+01 | -5.9   |
| BOPA1_272_944       | WW     | MAT   | 5H  | 118    | 2.03E+01 | 2.73   |
| BOPA2_12_30894      | WW     | HEA   | 7H  | 34.2   | 2.92E+01 | 6.2    |
| BOPA2_12_30894      | WW     | MAT   | 7H  | 34.2   | 1.83E+01 | 3      |
| BOPA2_12_30083      | WW     | GFP   | 7H  | 45     | 9.89E+00 | -7.2   |
Table S5 QxE loci for the different traits over two years trials. The effect is calculated as the difference between the effect of the wild allele under WW and WL. Positive values indicate higher increasing or less reducing effect of the wild allele under WL. DR, Detection rate calculated across 200 repeated subsamples of 70% from HRB-25 population (see Methods)

| Marker          | Trait | chr | cM  | DR [%] | effect |
|-----------------|-------|-----|-----|--------|--------|
| BOPA2_12_30304  | PGY   | 1H  | 57.3| 64     | 8.01   |
| SCRI_RS_216088  | PGY   | 1H  | 122.2| 80     | 10.95  |
| SCRI_RS_216088  | GN    | 1H  | 122.2| 91     | 15.37  |
| SCRI_RS_188893  | GFP   | 2H  | 20  | 63.5   | -6.06  |
| SCRI_RS_157207  | VDW   | 2H  | 57.4| 58.5   | 5.45   |
| SCRI_RS_100054  | PGY   | 2H  | 57.4| 100    | 13.65  |
| SCRI_RS_208320  | GN    | 2H  | 57.4| 95     | 19.08  |
| SCRI_RS_196026  | GFP   | 2H  | 57.4| 78.5   | 6.2    |
| SCRI_RS_185710  | TDM   | 2H  | 57.4| 100    | 4.69   |
| SCRI_RS_146425  | PGY   | 3H  | 44.8| 100    | 13.24  |
| SCRI_RS_230096  | GN    | 3H  | 44.8| 97     | 11.59  |
| SCRI_RS_223894  | VDW   | 3H  | 51.6| 96.5   | -8     |
| SCRI_RS_173348  | PGY   | 3H  | 51.6| 86     | 7.7    |
| SCRI_RS_173348  | GN    | 3H  | 51.6| 61.5   | 8.6    |
| SCRI_RS_206510  | PGY   | 3H  | 103.8| 100   | 4.75   |
| SCRI_RS_206510  | GN    | 3H  | 103.8| 54.5  | 6.76   |
| SCRI_RS_138221  | GN    | 5H  | 98.1| 82.5   | -13.47 |
| SCRI_RS_231239  | TDM   | 5H  | 109.7| 73    | -4.49  |
| SCRI_RS_207174  | GFP   | 6H  | 54.9| 33.5   | 2.96   |
| SCRI_RS_204148  | PGY   | 6H  | 61  | 89.5   | 2.58   |
| SCRI_RS_219709  | TDM   | 7H  | 24.5| 67     | -4.65  |
| SCRI_RS_187827  | TDM   | 7H  | 43.8| 68.5   | -3.7   |
Table S6  Pot experiment  ANOVA

Analysis of variance (ANOVA) for the measured traits: total DM (TDM, gr/plant), plant grain yield (PGY, gr/plant), harvest index (HI), spike per plant, grain number of three first spike (GN- first three), grain number (GN all), grain weight of three first spike (GW- first three), grain weight (GW, all), days from planting to booting (HEA, days), ripening period (RIP, days), Flag leaf sheath (cm) length, stem diameter (cm), -1 flag leaf blade width (cm), -1 flag leaf blade length.

| Source                      | Irrigation Treatment | Genotype       | Irrigation x Genotype | d.f. error |
|-----------------------------|----------------------|----------------|-----------------------|------------|
|                             | (d.f.=2)             | (d.f.=1)       | (d.f.=2)              |            |
|                             | F ratio              | F ratio        | F ratio               |            |
| TDM                         | 57.05                | 0.08           | 0.21                  | 49         |
|                             | ***                  |                |                       |            |
| PGY                         | 14.94                | 8.83           | 2.82                  | 45         |
|                             | ***                  | **             |                       |            |
| HI                          | 10.58                | 7.76           | 0.53                  | 44         |
|                             | **                   | **             |                       |            |
| Spike number                | 4.27                 | 2.1            | 0.4                   | 48         |
|                             | *                    |                |                       |            |
| GN- three first spike       | 1.01                 | 4.72           | 2.8                   | 38         |
|                             | *                    |                |                       |            |
| GN- all                     | 1.78                 | 3.09           | 2.54                  | 40         |
|                             | ^                    | ^              |                       |            |
| TGW- three first spike      | 3.09                 | 3.67           | 1.06                  | 38         |
|                             | ^                    | ^              |                       |            |
| TGW- all                    | 10.62                | 3.48           | 1.36                  | 38         |
|                             | ***                  |                |                       |            |
| HEA                         | 7.27                 | 6.43           | 0.45                  | 49         |
|                             | ***                  | *              |                       |            |
| GFP                         | 4.03                 | 4.43           | 0.21                  | 42         |
|                             | *                    |                |                       |            |
| FL sheath length            | 2.11                 | 4.98           | 1.36                  | 42         |
|                             | *                    |                |                       |            |
| Stem diameter               | 1.07                 | 8.77           | 0.05                  | 48         |
|                             | ***                  |                |                       |            |
| minus 1 FL width            | 5.21                 | 9.83           | 2.11                  | 42         |
|                             | **                   | **             |                       |            |
| minus 1 FL length           | 5.34                 | 26.22          | 0.79                  | 42         |
|                             | ***                  | ***            |                       |            |
| Senescence                  | 10.73                | 4.17           | 0.33                  | 47         |
|                             | ***                  |                |                       |            |

*, **, *** represent $P < 0.05$, 0.01 and 0.001, respectively.

^ represent $P < 0.1$
library(GWAF)

library(kinship2)

ped=read.csv(file="ped_file.csv", header=TRUE, sep=",")

kmat<-makekinship(ped$famid, ped$id, ped$fa, ped$mo)

kmat<-kmat*2

save(kmat, file="heb_interaction_kinship.Rdata")

lmepack.int.batch(phenfile="trait.csv", genfile="geno_file.csv", pedfile="ped_file.csv", kinmat="heb_interaction_kinship.Rdata", phen="trait", outfile="trait.lme.quant.int.csv", covars=c('dry'), cov.int='dry', sub='N', sep.ped=';', sep.phe=';', sep.gen=';', col.names=F)