

Table S1 Estimation of GCA effects of 7 parents along with their mean performance for 6 characters in the F<sub>1</sub> generation of wheat

| Parent     | SDW   |            | RDW   |            | MRL  |            | N%    |            | gN    |            | NUE    |            |
|------------|-------|------------|-------|------------|------|------------|-------|------------|-------|------------|--------|------------|
|            | mean  | GCA effect | mean  | GCA effect | mean | GCA effect | mean  | GCA effect | mean  | GCA effect | mean   | GCA effect |
| 1          | 0.737 | 0.074***   | 0.063 | 0.005*     | 30   | 2.151*     | 1.624 | -0.111**   | 0.012 | 0.001*     | 32.022 | 3.202***   |
| 2          | 0.777 | 0.074***   | 0.054 | 0.006*     | 27   | 2.095*     | 1.818 | 0.031      | 0.014 | 0.002*     | 33.761 | 3.224***   |
| 3          | 0.517 | -0.025*    | 0.04  | 0.003      | 27   | -0.683     | 1.963 | 0.008      | 0.01  | 0.000      | 22.478 | -1.105*    |
| 4          | 0.661 | 0.002      | 0.023 | -0.011**   | 23.5 | -2.794**   | 2.083 | -0.172**   | 0.014 | 0.000      | 28.718 | 0.096      |
| 5          | 0.552 | -0.067***  | 0.048 | 0.001      | 24.5 | 0.762      | 1.847 | 0.353***   | 0.011 | -0.001     | 23.978 | -2.914***  |
| 6          | 0.527 | -0.029*    | 0.045 | 0.002      | 25   | -1.738*    | 1.372 | -0.009     | 0.008 | -0.001     | 22.913 | -1.243*    |
| 7          | 0.515 | -0.029*    | 0.04  | -0.007*    | 22.5 | 0.206      | 1.965 | -0.101**   | 0.01  | -0.001*    | 21.788 | -1.259*    |
| SE (gi)    |       | 0.009      |       | 0.002      |      | 0.617      |       | 0.033      |       | 0          |        | 0.414      |
| SE (gi-gj) |       | 0.015      |       | 0.004      |      | 0.943      |       | 0.051      |       | 0.001      |        | 0.632      |

Level of significance, \* at 5%; \*\* at 1%, \*\*\* at 0.1

SDW= Shoot dry weight (g), RDW= Root dry weight (g), MRL= Maximum root length (cm), N%= Nitrogen percent in shoot, gN= Gram N in shoot, NUE= Nitrogen use efficiency

Table S2 Estimation of SCA effects and corresponding mean performance of 6 characters in 7 × 7 diallel cross of wheat

| cross  | SDW   |            | RDW   |            | MRL  |            | N%    |            | gN    |            | NUE    |            |
|--------|-------|------------|-------|------------|------|------------|-------|------------|-------|------------|--------|------------|
|        | mean  | SCA effect | mean  | SCA effect | mean | SCA effect | mean  | SCA effect | mean  | SCA effect | mean   | SCA effect |
| 1×2    | 0.54  | -0.064*    | 0.057 | 0          | 28   | -3.514     | 1.998 | -0.612***  | 0.011 | -0.004**   | 24.348 | -2.821*    |
| 1×3    | 0.57  | 0.028      | 0.073 | 0.019**    | 31.5 | 2.764      | 2.717 | 0.13       | 0.015 | 0.001      | 24.022 | 1.182      |
| 1×4    | 0.458 | -0.079**   | 0.036 | -0.003     | 23.5 | -3.125     | 2.989 | 0.583      | 0.014 | 0.001      | 20.609 | -3.432**   |
| 1×5    | 0.39  | -0.084**   | 0.024 | -          | 29.5 | -0.681     | 3.343 | 0.411***   | 0.013 | 0.001      | 17.348 | -3.683**   |
|        |       |            |       | 0.029***   |      |            |       |            |       |            |        |            |
| 1×6    | 0.611 | 0.118***   | 0.051 | -0.003     | 33.5 | 5.819**    | 2.826 | 0.256*     | 0.018 | 0.005***   | 27.826 | 5.124***   |
| 1×7    | 0.34  | -0.143***  | 0.045 | 0.001      | 31.5 | 1.875      | 3.401 | 0.919***   | 0.013 | 0.001      | 16.435 | -6.121***  |
| 2×3    | 0.433 | -0.079**   | 0.048 | -0.006     | 23.5 | -5.181**   | 3.697 | 0.97***    | 0.016 | 0.002      | 19.391 | -3.47**    |
| 2×4    | 0.669 | 0.153***   | 0.049 | 0.009      | 31   | 4.431*     | 3.044 | 0.496***   | 0.022 | 0.008***   | 30.717 | 6.655***   |
| 2×5    | 0.31  | -0.201***  | 0.075 | 0.023**    | 40   | 9.875***   | 3.686 | 0.613***   | 0.010 | -0.003**   | 12.304 | -8.748***  |
| 2×6    | 0.287 | -0.194***  | 0.035 | -0.019*    | 30   | 2.375      | 2.701 | -0.01      | 0.009 | -0.005***  | 14.283 | -8.441***  |
| 2×7    | 0.531 | 0.082**    | 0.042 | -0.001     | 30.5 | 0.931      | 3.034 | 0.411***   | 0.018 | 0.005***   | 26.261 | 3.683**    |
| 3×4    | 0.23  | -0.242***  | 0.046 | 0.01       | 22.5 | -1.292     | 1.615 | -0.91***   | 0.003 | -0.009***  | 9.196  | -10.538*** |
| 3×5    | 0.512 | 0.102**    | 0.038 | -0.012     | 31   | 3.653      | 3.511 | 0.461***   | 0.017 | 0.005***   | 21.130 | 4.407**    |
| 3×6    | 0.46  | 0.076*     | 0.071 | 0.02**     | 21.5 | -3.347     | 4.408 | 1.72***    | 0.022 | 0.01***    | 21.696 | 3.3*       |
| 3×7    | 0.354 | -0.066*    | 0.033 | -0.008     | 28   | 1.208      | 1.713 | -0.888***  | 0.006 | -0.005***  | 15.478 | -2.771*    |
| 4×5    | 0.33  | -0.104**   | 0.028 | -0.006     | 26   | 0.764      | 3.325 | 0.454***   | 0.010 | -0.001     | 13.370 | -4.555***  |
| 4×6    | 0.35  | -0.113***  | 0.025 | -0.011     | 13   | -          | 2.583 | 0.076      | 0.009 | -0.003*    | 14.652 | -4.944***  |
|        |       |            |       |            |      | 9.736***   |       |            |       |            |        |            |
| 4×7    | 0.429 | 0.026      | 0.023 | -0.003     | 30   | 5.319**    | 2.248 | -0.174     | 0.011 | 0          | 20.696 | 1.246      |
| 5×6    | 0.34  | -0.071*    | 0.078 | 0.029***   | 24.5 | -1.792     | 3.492 | 0.459***   | 0.011 | 0          | 13.478 | -3.108*    |
| 5×7    | 0.352 | -0.059*    | 0.036 | -0.003     | 25   | -3.236     | 3.646 | 0.699***   | 0.012 | 0.001      | 14.000 | -2.44*     |
| 6×7    | 0.433 | -0.031     | 0.034 | -0.006     | 30   | 4.264*     | 2.681 | 0.097      | 0.010 | -0.001     | 16.870 | -1.242     |
| S(I,J) |       | 0.028      |       | 0.007      |      | 1.795      |       | 0.097      |       | 0.001      |        | 1.204      |

Level of significance, \* at 5%; \*\* at 1%, \*\*\* at 0.1; SDW= Shoot dry weight (g), RDW= Root dry weight (g), MRL= Maximum root length (cm), N%= Nitrogen percent in shoot, gN= Gram N in shoot, NUE= Nitrogen use efficiency

Table S3 Ranking of 7 parents on the basis of GCA effect for 6 characters in F<sub>1</sub>

| Parent | Rank on the basis of GCA effect |     |     |    |    |     |       |         |
|--------|---------------------------------|-----|-----|----|----|-----|-------|---------|
|        | SDW                             | RDW | MRL | N% | gN | NUE | score | ranking |
| 2      | 1                               | 1   | 2   | 2  | 1  | 1   | 8     | 1       |
| 1      | 2                               | 2   | 1   | 6  | 2  | 2   | 15    | 2       |
| 3      | 4                               | 3   | 5   | 3  | 3  | 4   | 22    | 3       |
| 5      | 7                               | 5   | 3   | 1  | 5  | 7   | 28    | 4       |
| 6      | 5                               | 4   | 6   | 4  | 6  | 5   | 30    | 5       |
| 4      | 3                               | 7   | 7   | 7  | 4  | 3   | 31    | 5       |
| 7      | 6                               | 6   | 4   | 5  | 7  | 6   | 34    | 6       |

Table S4 Ranking of 21 crosses on the basis of SCA effect for 6 characters in F<sub>1</sub>

| Cross | Rank on the basis of SCA effect |     |     |    |    |     |       |      |
|-------|---------------------------------|-----|-----|----|----|-----|-------|------|
|       | SDW                             | RDW | MRL | N% | gN | NUE | Score | Rank |
| 3x6   | 5                               | 3   | 18  | 1  | 1  | 5   | 33    | 1    |
| 2x4   | 1                               | 6   | 20  | 7  | 2  | 1   | 37    | 2    |
| 1x6   | 2                               | 11  | 13  | 13 | 3  | 2   | 44    | 3    |
| 2x7   | 4                               | 9   | 11  | 12 | 4  | 4   | 44    | 4    |
| 3x5   | 3                               | 19  | 6   | 8  | 5  | 3   | 44    | 5    |
| 1x3   | 6                               | 4   | 19  | 14 | 7  | 7   | 57    | 6    |
| 1x4   | 13                              | 10  | 7   | 6  | 8  | 13  | 57    | 7    |
| 1x7   | 18                              | 7   | 2   | 3  | 10 | 18  | 58    | 8    |
| 4x7   | 7                               | 12  | 3   | 18 | 12 | 6   | 58    | 9    |
| 2x3   | 14                              | 14  | 9   | 2  | 6  | 14  | 59    | 10   |
| 5x6   | 12                              | 1   | 15  | 9  | 13 | 12  | 62    | 11   |
| 5x7   | 9                               | 13  | 17  | 4  | 11 | 9   | 63    | 12   |
| 1x2   | 10                              | 8   | 1   | 19 | 18 | 11  | 67    | 13   |
| 2x5   | 20                              | 2   | 4   | 5  | 16 | 20  | 67    | 14   |
| 6x7   | 8                               | 16  | 5   | 15 | 15 | 8   | 67    | 15   |
| 4x5   | 16                              | 15  | 12  | 10 | 14 | 16  | 83    | 16   |
| 1x5   | 15                              | 21  | 16  | 11 | 9  | 15  | 87    | 17   |
| 3x7   | 11                              | 17  | 10  | 20 | 20 | 10  | 88    | 18   |
| 2x6   | 19                              | 20  | 8   | 17 | 19 | 19  | 102   | 19   |
| 3x4   | 21                              | 5   | 14  | 21 | 21 | 21  | 103   | 20   |
| 4x6   | 17                              | 18  | 21  | 16 | 17 | 17  | 106   | 21   |