**Supplementary materials**

**Supplementary Figure 1** Frequency distributions of the PH **(A)** and NN **(B)** traits in the SBL population. Shown is the average of each trait in the population over two environments across three stages each with three replicates.

**Supplementary Figure 2** Plot of the correlation coefficients of each pair of traits.

**Supplementary Figure 3** Distribution of the haplotype blocks among the whole genome.

**Supplementary Figure 4** The haplotype analysis of the two major loci for PH and NN at three stages.

**(A)** Comparison of the PH among the haplotypes of H2842 and the PH between the haplotypes of H5441 at three stages using a Duncan's multiple range test (*P<* 0.01) and an independent *t*-test (\*\* *P*<0.01), respectively. **(B)** Comparison of the NN among the haplotypes of H2842 and the NN between the haplotypes of H5441 at three stages using a Duncan's multiple range test (*P<* 0.01) and an independent *t*-test, respectively.

**Supplementary Figure 1**

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**Supplementary Figure 2**

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Significant at *P*<0.0001

**Supplementary Figure 3**

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**Supplementary Figure 4**

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