

Supplementary Table S1: Correlation coefficients for the association of Zn efficiency with different traits in both experiments 2 and 3 at early vegetative stage.

|   | <b>Experiment 2</b>               | <b>Experiment 3</b>               |
|---|-----------------------------------|-----------------------------------|
| Initial seed Zn concentration (mg kg <sup>-1</sup> )  | r = 0.626 <sup>NS</sup><br>(n=10) | r = -0.099 <sup>NS</sup><br>(n=4) |
| Leaf deficiency symptom scores                        | R = -0.12 <sup>NS</sup><br>(n=25) | r = -0.14 <sup>NS</sup><br>(n=10) |
| Root to shoot Zn translocation (%)                    | r = 0.5**<br>(n=25)               | r = 0.6*<br>(n=12)                |
| Total Zn uptake (µg plant <sup>-1</sup> )             | r = 0.19 <sup>NS</sup><br>(n=23)  | r = 0.78**<br>(n=13)              |
| Max. root length (cm)                                 | r = 0.12 <sup>NS</sup><br>(n=26)  | r = -0.01 <sup>NS</sup><br>(n=15) |
| Shoot Zn concentration (mg kg <sup>-1</sup> )         | r = 0.02 <sup>NS</sup><br>(n=25)  | ND                                |
| Leaf blade Zn concentration (mg kg <sup>-1</sup> )    | ND                                | r = 0.46 <sup>NS</sup><br>(n=15)  |
| Stem + sheath Zn concentration (mg kg <sup>-1</sup> ) | ND                                | r = 0.04 <sup>NS</sup><br>(n=15)  |
| Root Zn concentration (mg kg <sup>-1</sup> )          | r = -0.06 <sup>NS</sup><br>(n=25) | r = 0.04 <sup>NS</sup><br>(n=15)  |

\*\*\*, \*\* and \* indicate significant correlations at  $p \leq 0.001$ , 0.01, and 0.05, respectively. NS = non-significant. ND= not determined.

Supplementary Table S2: Shoot and root Zn concentration, total Zn content per plant, and root-to-shoot Zn translocation index at early vegetative stage under Zn-sufficient and Zn-deficient conditions in experiment 2

| Genotype            | Shoot Zn concentration<br>(mg kg <sup>-1</sup> ) |                  | Root Zn concentration<br>(mg kg <sup>-1</sup> ) |                    | Total Zn content<br>(µg plant <sup>-1</sup> ) |                  | Root-to-shoot Zn<br>translocation index (%) |              |
|---------------------|--|------------------|---|--------------------|---|------------------|---|--------------|
|                     | Zn-<br>sufficient                                | Zn-<br>deficient | Zn-<br>sufficient                               | Zn-<br>deficient   | Zn-<br>sufficient                             | Zn-<br>deficient | Zn-<br>sufficient                           | Zn-deficient |
| IR64                | 18.5   | 7.0              | 39.5  | 13.0               | 38.7  | 24.6             | 58  | 57           |
| IR68144             | 36.0   | 12.7             | 20.0  | 14.5               | 29.9  | 8.7              | 82  | 61           |
| IR74                | 19.0   | 6.4              | 21.5  | 13.3               | 68.7  | 24.2             | 66  | 53           |
| IR82247             | 18.3   | 8.0              | 15.5  | 13.7               | 46.0  | 23.9             | 78  | 62           |
| IR69428             | 23.7   | 11.0             | 23.0  | 13.5               | 63.6  | 27.3             | 73  | 57           |
| IR75862             | 23.7   | 8.0              | 23.7  | 11.0               | 43.5  | 18.2             | 73  | 66           |
| Jalmagna            | 12.7   | 5.6              | 13.5  | 13.6               | 69.7  | 34.7             | 80  | 53           |
| Joryoongbyeon       | 22.7   | 9.5              | 21.5  | 11.7               | 46.0  | 17.7             | 75  | 70           |
| RIL-46              | 21.0   | 6.5              | 34.5  | 12.0               | 72.0  | 21.4             | 73  | 61           |
| SWHOO               | 19.7   | 9.5              | 21.0  | 14.3               | 51.6  | 27.3             | 76  | 68           |
| 5% HSD genotype     |  | 4.1***           |   | 10.0 <sup>NS</sup> |   | 10.5***          |   | 10***        |
| 5% LSD Zn treatment |  | 1.0***           |   | 2.7***             |   | 2.8***           |   | 3***         |
| 5% HSD (G X Zn)     |  | 6.7***           |   | 16.2**             |   | 17***            |   | 15**         |

Values given are means ± SE (n = 3). \*\*\*, \*\* indicate significant differences at p ≤ 0.001 and 0.01, respectively.

Supplementary Table S3: Different plant tissue Zn concentration, total Zn content per plant, and root-to-shoot Zn translocation index at early vegetative stage under Zn-sufficient and Zn-deficient conditions in experiment 3

| Genotype            | Leaf blade Zn concentration (mg kg <sup>-1</sup> ) |              | Stem and sheath Zn concentration (mg kg <sup>-1</sup> ) |              | Root Zn concentration (mg kg <sup>-1</sup> ) |              | Total Zn content (µg plant <sup>-1</sup> ) |              | Root-to-shoot Zn translocation index (%) |              |
|---------------------|--|--------------|---|--------------|--|--------------|--|--------------|--|--------------|
|                     | Zn-sufficient                                      | Zn-deficient | Zn-sufficient   | Zn-deficient | Zn-sufficient                                | Zn-deficient | Zn-sufficient                              | Zn-deficient | Zn-sufficient                            | Zn-deficient |
| A69-1               | 36.0   | 10.5         | 120.4   | 10.4         | 29.8   | 15.6         | 82.0                                       | 8.0          | 87                                       | 68           |
| IR55179             | 45.0   | 10.4         | 107.2   | 10.7         | 34.0   | 14.5         | 76.4                                       | 9.8          | 85                                       | 65           |
| IR69428             | 53.8   | 12.6         | 105.2   | 10.3         | 42.5   | 16.3         | 72.2                                       | 7.3          | 83                                       | 65           |
| KP                  | 47.0   | 10.7         | 145.3   | 8.6          | 21.3   | 14.8         | 113.0                                      | 7.0          | 85                                       | 64           |
| 5% LSD genotype     |  | 2.7***       |   | 6.8***       |  | 5.0*         |  | 3.5***       |  | 5 NS         |
| 5% LSD Zn treatment |  | 1.9***       |   | 4.8***       |  | 3.5***       |  | 2.4***       |  | 3***         |
| 5% HSD (G X Zn)     |  | 6.0***       |   | 15.6***      |  | 11.3 NS      |  | 8.0***       |  | 10 NS        |

Values are means ± SE (n = 5). \*\*\*, \*\*, \* indicate significant difference at p ≤ 0.001, 0.01, and 0.05, respectively.

Supplementary Table S4: Different plant tissue Zn concentration at 50% flowering under Zn-sufficient and Zn-deficient conditions

| Geno name           | Leaf blade Zn concentration (mg kg <sup>-1</sup> ) |              | Stem and sheath Zn concentration (mg kg <sup>-1</sup> ) |              | Root Zn Concentration (mg kg <sup>-1</sup> ) |              | Panicle Zn concentration (mg kg <sup>-1</sup> ) |              |
|---------------------|--|--------------|---|--------------|--|--------------|---|--------------|
|                     | Zn-sufficient                                      | Zn-deficient | Zn-sufficient   | Zn-deficient | Zn-sufficient                                | Zn-deficient | Zn-sufficient                                   | Zn-deficient |
| <u>Experiment 2</u> |  |              |   |              |  |              |   |              |
| IR64                | 24 ± 2   | 27 ± 5       | 26 ± 1  | 37 ± 18      | 48 ± 8                                       | 58 ± 12      | 39 ± 0.5  | 35 ± 2       |
| IR68144             | 33 ± 5   | 21 ± 3       | 28 ± 6  | 14 ± 1       | 36 ± 4                                       | 27 ± 5       | 50 ± 0  | 31 ± 0       |
| IR74                | 26 ± 1   | 17 ± 1       | 25 ± 3  | 33 ± 9       | 60 ± 16                                      | 44 ± 19      | 34 ± 0.4  | 30 ± 1.5     |
| IR82247             | 22 ± 0   | 19 ± 2       | 19 ± 3.7  | 24 ± 7       | 34 ± 10                                      | 106 ± 14     | 47 ± 11   | 42 ± 0       |
| IR69428             | 25 ± 2   | 22 ± 2       | 22 ± 2  | 21 ± 1       | 75 ± 5                                       | 41 ± 9       | 62 ± 0  | 49 ± 0       |
| IR75862             | 22 ± 2   | 17 ± 2       | 19 ± 2  | 13 ± 3       | 66 ± 15                                      | 53 ± 14      | 49 ± 0  | 18 ± 4       |
| Joryoongbyeo        | 23 ± 3   | 19 ± 1       | 29 ± 8  | 30 ± 11      | 78 ± 15                                      | 56 ± 16      | 75 ± 2  | 57 ± 0       |
| RIL-46              | 18 ± 3   | 17 ± 0       | 21 ± 2  | 18 ± 5       | 22 ± 6                                       | 62 ± 24      | 49 ± 4  | 30 ± 4       |
| SWHOO               | 39 ± 14  | 23 ± 4       | 41.2 ± 14   | 26 ± 7       | 57 ± 11                                      | 51 ± 8       | 55 ± 6  | 50 ± 6       |
| <u>Experiment 3</u> |  |              |   |              |  |              |   |              |
| A69-1               | 19 ± 1   | 11 ± 1       | 29 ± 2  | 8 ± 2        | 131 ± 13                                     | 14 ± 0.3     | 35 ± 1  | 9 ± 2        |
| IR55179             | 22 ± 2   | 13 ± 1       | 23 ± 4  | 8 ± 1        | 166 ± 10                                     | 23 ± 4       | 29 ± 1  | 8 ± 0.2      |
| IR69428             | 26 ± 2   | 14 ± 1       | 29 ± 6  | 10 ± 2       | 179 ± 22                                     | 20 ± 4       | 46 ± 2  | 19 ± 3       |
| KP                  | 23 ± 3   |              | 24 ± 8  |              | 150 ± 46                                     | -            | 27 ± 3  | -            |

Supplementary Table S5: Different plant tissue Zn concentration at maturity under Zn-sufficient and Zn-deficient conditions

| Geno name           | Root Zn concentration (mg kg <sup>-1</sup> ) |              | Stem and sheath Zn concentration (mg kg <sup>-1</sup> ) |              | Leaf blade Zn concentration (mg kg <sup>-1</sup> ) |              | Rachis Zn concentration (mg kg <sup>-1</sup> ) |              | Brown rice Zn concentration (mg kg <sup>-1</sup> ) |              |
|---------------------|--|--------------|---|--------------|--|--------------|--|--------------|--|--------------|
|                     | Zn-sufficient                                | Zn-deficient | Zn-sufficient   | Zn-deficient | Zn-sufficient                                      | Zn-deficient | Zn-sufficient                                  | Zn-deficient | Zn-sufficient                                      | Zn-deficient |
| <u>Experiment 2</u> |  |              |   |              |  |              |  |              |  |              |
| IR64                | 55 ± 9                                       | 92 ± 5       | 24 ± 3  | 17 ± 2       | 23 ± 1   | 22 ± 2       | 15 ± 1   | 9 ± 1        | 26 ± 2   | 17 ± 2       |
| IR68144             | 91 ± 10                                      | 160 ± 40     | 32 ± 1  | 15 ± 2       | 26 ± 2   | 19 ± 1       | 19 ± 2   | 9 ± 1        | 24 ± 1   | 12 ± 0.9     |
| IR74                | 40 ± 6                                       | 86 ± 8       | 26 ± 2  | 20 ± 1       | 24 ± 2   | 20 ± 2       | 21 ± 2   | 15 ± 1       | 21 ± 2   | 16 ± 1.5     |
| IR82247             | 66 ± 3                                       | 100 ± 4      | 26 ± 4  | 18 ± 2       | 23 ± 1   | 19 ± 1       | 19 ± 3   | 13 ± 1       | 18 ± 2   | 16 ± 2       |
| IR69428             | 87 ± 10                                      | 130 ± 8      | 23 ± 1  | 17 ± 2       | 24 ± 2   | 21 ± 2       | 28 ± 6   | 17 ± 0       | 35 ± 4   | 23 ± 1       |
| IR75862             | 62 ± 4                                       | 89 ± 7       | 18 ± 2  | 13 ± 2       | 19 ± 1   | 17 ± 1       | 34 ± 12  | 9 ± 1        | 29 ± 4   | 18 ± 6.5     |
| Joryoongbyeon       | 74 ± 8                                       | 107 ± 2      | 19 ± 1  | 18 ± 4       | 17 ± 2   | 15 ± 1       | 29 ± 4   | 27 ± 2       | 33 ± 3   | 35 ± 3       |
| RIL-46              | 30 ± 1                                       | 92 ± 6       | 22 ± 2  | 15 ± 3       | 22 ± 2   | 18 ± 2       | 13 ± 0.5                                       | 9 ± 2        | 26 ± 1   | 20 ± 3       |
| SWHOO               | 47 ± 2                                       | 125 ± 8      | 21 ± 1  | 12 ± 1       | 17 ± 2   | 14 ± 1       | 30 ± 5   | 11 ± 1       | 38 ± 0.6   | 32 ± 3       |
| <u>Experiment 3</u> |  |              |   |              |  |              |  |              |  |              |
| A69-1               | 349 ± 24                                     | 31 ± 3       | 24 ± 1  | 13 ± 4       | 20 ± 1   | 13 ± 1       | 16 ± 1   | 8 ± 1        | 32 ± 2   | 10 ± 2       |
| IR55179             | 391 ± 36                                     | 34 ± 4       | 24 ± 4  | 8 ± 0.4      | 22 ± 2   | 13 ± 1       | 13 ± 2   | 5 ± 1        | 20 ± 2   | 7 ± 2        |
| IR69428             | 465 ± 41                                     | 43 ± 9       | 23 ± 3  | 13 ± 2       | 22 ± 2   | 17 ± 1       | 56 ± 11  | 16 ± 3       | 30 ± 3   | 18 ± 1       |
| KP                  | 224 ± 28                                     |              | 20 ± 2  |              | 22 ± 2   |              | 8 ± 1  |              | 12 ± 2   | -            |