

Supplementary Material

Accumulation of zinc, iron and selenium in wheat as affected by phosphorus supply in salinised condition

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Supplementary Table S1. Origin and agronomic traits of tested 20

wheat genotypes in pot study 2

| Genotype | Origin of country | Type | Agronomic traits | | | | | | | |
|----------------|-------------------|----------|------------------|-----|------|---------|------|---------|---------|-----------|
| | | | PH (cm) | HP | GH | HL (cm) | Spik | TKW (g) | StB (g) | Yield (g) |
| Huang mang bai | China | landrace | 106.2 | 2.8 | 44.3 | 9.2 | 21.2 | 31.0 | 8.3 | 3.7 |
| FAO 33.216 | Pakistan | landrace | 84.1 | 2.2 | 37.7 | 11.0 | 18.0 | 44.3 | 6.8 | 3.3 |
| TJK03-194 | Tajikistan | landrace | 92.3 | 2.8 | 34.0 | 10.3 | 19.7 | 44.4 | 10.0 | 4.1 |
| TAM 303 | USA | landrace | 79.7 | 4.0 | 42.0 | 10.6 | 18.4 | 33.3 | 10.6 | 5.3 |
| Windstar | USA | landrace | 88.6 | 4.4 | 49.2 | 10.1 | 19.2 | 33.1 | 14.1 | 6.6 |
| Alice | USA | landrace | 66.1 | 3.3 | 46.2 | 9.5 | 18.5 | 32.2 | 9.1 | 4.8 |
| 13109 | Afghanistan | landrace | 89.2 | 2.3 | 43.5 | 10.3 | 17.8 | 37.6 | 7.9 | 3.6 |
| Hatcher | USA | landrace | 74.0 | 4.2 | 37.7 | 9.8 | 18.4 | 31.3 | 10.1 | 4.6 |
| 451 | Afghanistan | landrace | 105.0 | 3.2 | 51.8 | 12.6 | 20.5 | 39.8 | 13.6 | 6.5 |
| TJK03-296 | Tajikistan | landrace | 86.1 | 3.0 | 56.5 | 11.7 | 22.7 | 32.5 | 12.6 | 5.4 |
| Cisco | USA | landrace | 68.8 | 3.7 | 47.2 | 9.2 | 20.2 | 30.6 | 9.8 | 4.9 |
| Wu hua tou | China | landrace | 97.9 | 4.0 | 36.4 | 8.5 | 19.0 | 28.1 | 9.3 | 4.0 |
| Da li No. 1 | China | landrace | 67.1 | 1.7 | 39.3 | 8.6 | 19.9 | 60.5 | 7.5 | 3.8 |
| Er mang mai | China | landrace | 89.6 | 4.2 | 44.8 | 6.9 | 19.4 | 25.2 | 8.7 | 4.4 |
| K397 | Pakistan | landrace | 92.9 | 2.3 | 47.5 | 10.8 | 17.2 | 49.4 | 10.6 | 5.5 |
| TAM 400 | USA | landrace | 64.1 | 4.3 | 39.7 | 9.1 | 15.8 | 32.8 | 10.8 | 5.6 |
| Ai Kang58 | China | cultivar | 51.9 | 2.0 | 37.4 | 6.7 | 19.0 | 43.0 | 6.7 | 4.6 |
| Ji mai 22 | China | cultivar | 66.3 | 2.0 | 37.0 | 7.2 | 18.5 | 46.9 | 7.9 | 6.1 |
| Liang xing 99 | China | cultivar | 66.5 | 2.5 | 33.7 | 7.4 | 17.9 | 45.0 | 7.4 | 6.4 |
| Yan nong 999 | China | cultivar | 65.1 | 2.3 | 37.7 | 7.6 | 18.5 | 44.9 | 6.3 | 4.7 |

Note: average value of season 2019, 2020 was shown for each agronomic trait. Abbreviations: PH, plant height; GH, grain number per head; HL, head length; Spik, spike number per head; TKW, thousand kernel weight; StB, straw biomass

Supplementary Table S2. Shoot Na, K, P, Ca, and Mg concentrations in wheat in pot study 1 imposed to three saline levels (S0, 0 g/kg soil; S1, 0.5 g/kg soil; S2, 1.0 g/kg soil) and four P levels (P0, 0 mg/kg soil; P50, 50 mg/kg soil; P120, 120 mg/kg soil; P240, 240 mg/kg soil).

| Salinity | P supply | Concentration (g/kg) | | | | |
|---------------------|----------|----------------------|---------|--------|--------|--------|
| | | Na | K | P | Ca | Mg |
| S0 | P0 | 3.4 a | 50.7 c | 4.5 b | 3.9 ab | 4.0 a |
| | P50 | 2.8 b | 76.2 a | 5.2 ab | 4.3 a | 4.1 a |
| | P120 | 3.0 ab | 60.5 b | 4.5 b | 3.3 b | 3.3 b |
| | P240 | 2.6 b | 69.5 ab | 5.8 a | 3.9 ab | 3.8 ab |
| S1 | P0 | 11.3 c | 69.4 a | 4.7 b | 5.4 c | 5.2 b |
| | P50 | 22.3 a | 39.3 d | 3.7 c | 6.2 b | 6.0 a |
| | P120 | 15.3 b | 47.9 c | 4.8 b | 6.9 a | 6.5 a |
| | P240 | 10.4 c | 58.9 b | 5.8 a | 4.5 d | 4.5 c |
| S2 | P0 | 21.7 a | 47.7 b | 5.1 b | 5.9 b | 5.6 b |
| | P50 | 20.4 a | 67.5 a | 5.8 a | 7.3 a | 6.5 a |
| | P120 | 12.8 b | 51.9 b | 4.2 c | 5.9 b | 5.3 bc |
| | P240 | 10.4 b | 60.6 a | 5.9 a | 5.4 b | 5.0 c |
| Source of variation | | | | | | |
| Salinity | | *** | *** | ns | *** | *** |
| P supply | | *** | ** | *** | *** | ** |
| Salinity × P supply | | *** | *** | ** | *** | ** |

*, **, and *** indicate significance at $P < 0.05$, 0.01, and 0.001, while ns indicates no significance respectively.

Supplementary Table S3. Total shoot Na, K, P, Ca, and Mg accumulation amount in wheat in pot study 1 imposed to three saline levels (S0, 0 g/kg soil; S1, 0.5 g/kg soil; S2, 1.0 g/kg soil) and four P levels (P0, 0 mg/kg soil; P50, 50 mg/kg soil; P120, 120 mg/kg soil; P240, 240 mg/kg soil).

| Salinity | P supply | Total amount in shoot (mg/pot) | | | | |
|---------------------|----------|--------------------------------|---------|--------|--------|--------|
| | | Na | K | P | Ca | Mg |
| S0 | P0 | 0.5 b | 7.0 b | 0.6 b | 0.5 b | 0.6 b |
| | P50 | 0.6 ab | 15.3 a | 1.0 a | 0.9 a | 0.8 a |
| | P120 | 0.7 a | 13.9 ab | 1.0 a | 0.8 ab | 0.8 a |
| | P240 | 0.5 b | 14.1 ab | 1.2 a | 0.8 ab | 0.8 a |
| S1 | P0 | 1.1 c | 6.9 a | 0.5 a | 0.5 b | 0.5 b |
| | P50 | 2.9 a | 5.2 b | 0.5 a | 0.8 a | 0.8 a |
| | P120 | 1.9 b | 5.8 b | 0.6 a | 0.8 a | 0.8 a |
| | P240 | 1.2 c | 7.0 a | 0.7 a | 0.5 b | 0.5 b |
| S2 | P0 | 1.2 bc | 2.5 d | 0.3 b | 0.3 c | 0.3 b |
| | P50 | 2.5 a | 8.2 a | 0.7 a | 0.9 a | 0.8 a |
| | P120 | 1.5 b | 5.9 c | 0.5 ab | 0.7 ab | 0.6 ab |
| | P240 | 1.1 c | 6.4 b | 0.6 a | 0.6 b | 0.5 b |
| Source of variation | | | | | | |
| Salinity | | *** | *** | *** | *** | *** |
| P supply | | *** | *** | *** | *** | *** |
| Salinity × P supply | | *** | *** | *** | ** | ** |

*, **, and *** indicate significance at $P < 0.05$, 0.01, and 0.001, while ns indicates no significance respectively.

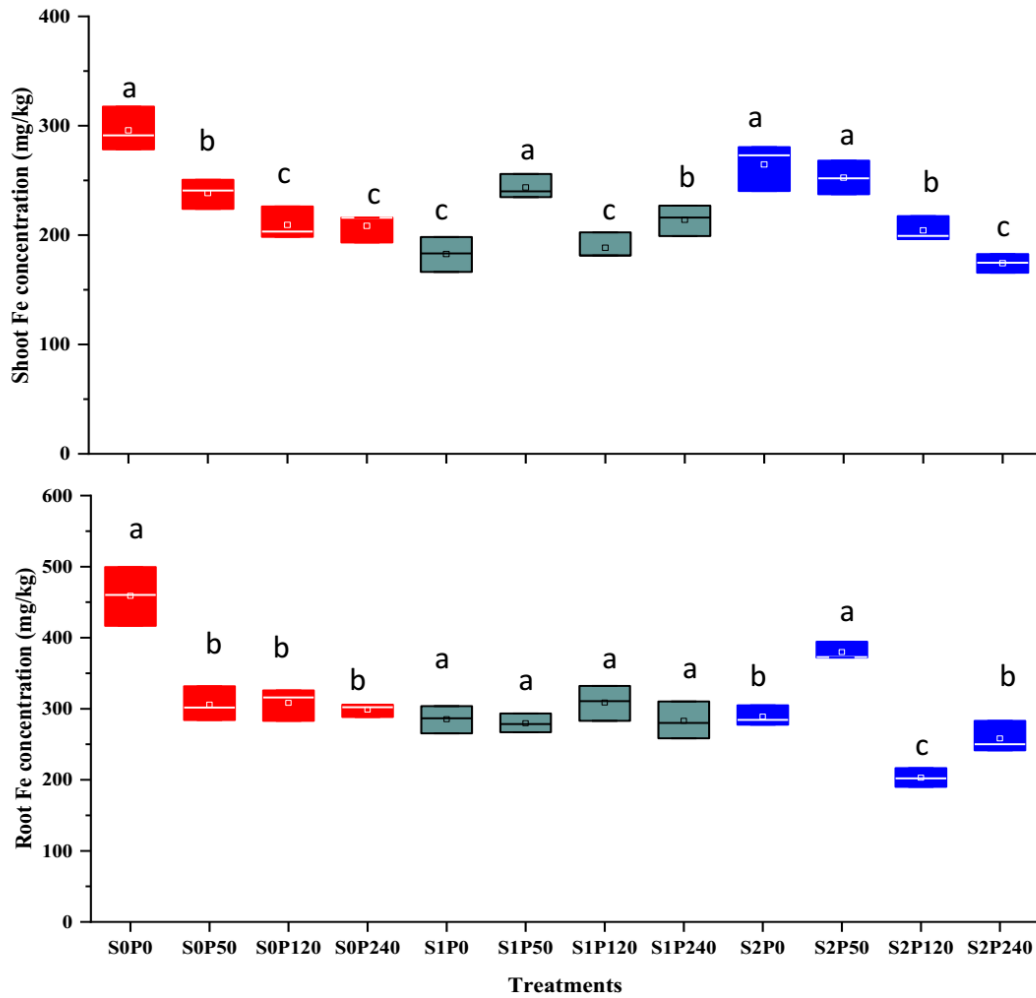
Supplementary Table S4. Correlations among shoot biomass, root weight, and Zn, Fe, Se concentrations in both shoot and root in pot study 1

| | Root weight | ZnCR | ZnCSh | FeCR | FeCSh | SeCR | SeCSh |
|----------------------|----------------|---------------|-----------------|---------------|----------------|----------------|----------------|
| Shoot biomass | 0.908** | 0.365* | -0.808** | 0.13 | -0.06 | 0.478** | 0.402* |
| Root weight | | 0.357* | -0.820** | 0.09 | -0.09 | 0.416* | 0.31 |
| ZnCR | | | -0.20 | 0.394* | 0.474** | 0.445** | 0.758** |
| ZnCSh | | | | -0.07 | 0.04 | -0.360* | -0.09 |
| FeCR | | | | | 0.661** | 0.25 | 0.462** |
| FeCSh | | | | | | 0.532** | 0.27 |
| SeCR | | | | | | | 0.19 |

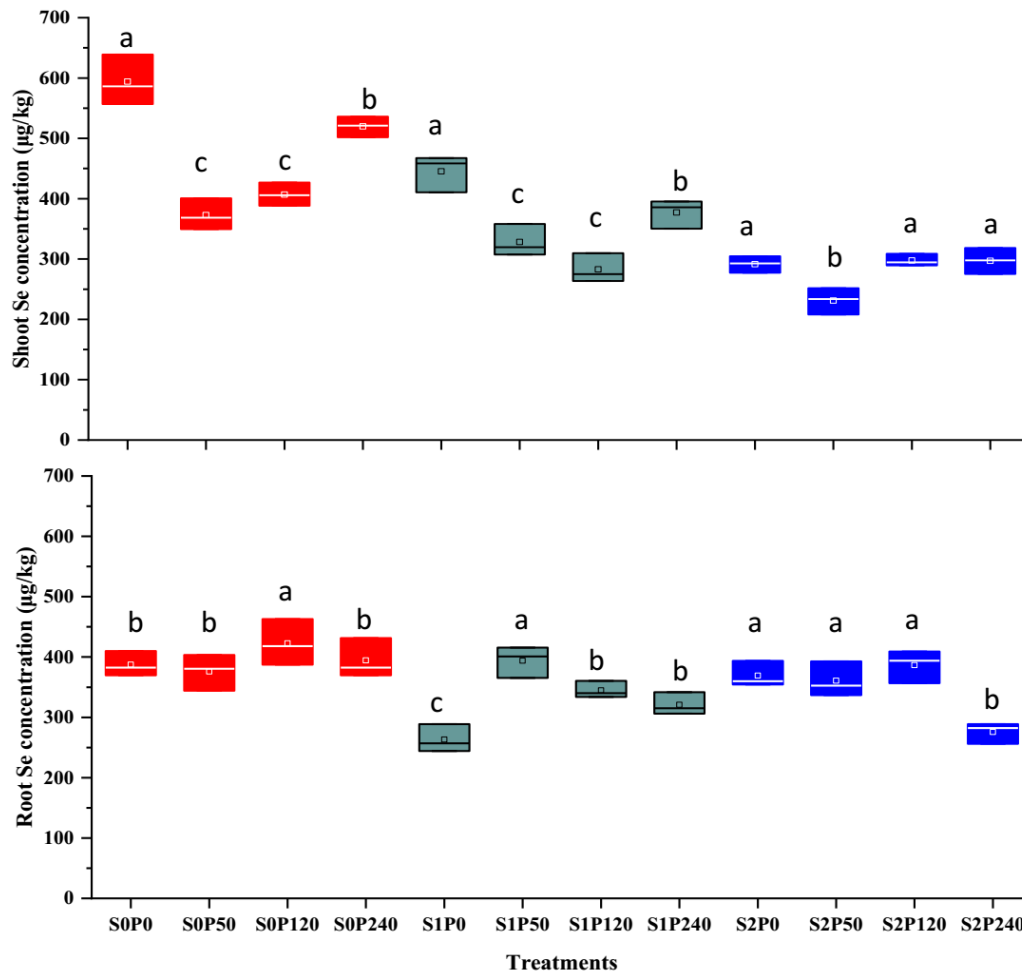
*, **, and *** indicate significance at $P < 0.05$, 0.01, and 0.001, while ns indicates no significance respectively.

Abbreviations: FeCR, Fe concentration in root; FeCSh, Fe concentration in shoot; SeCR, Se concentration in root;

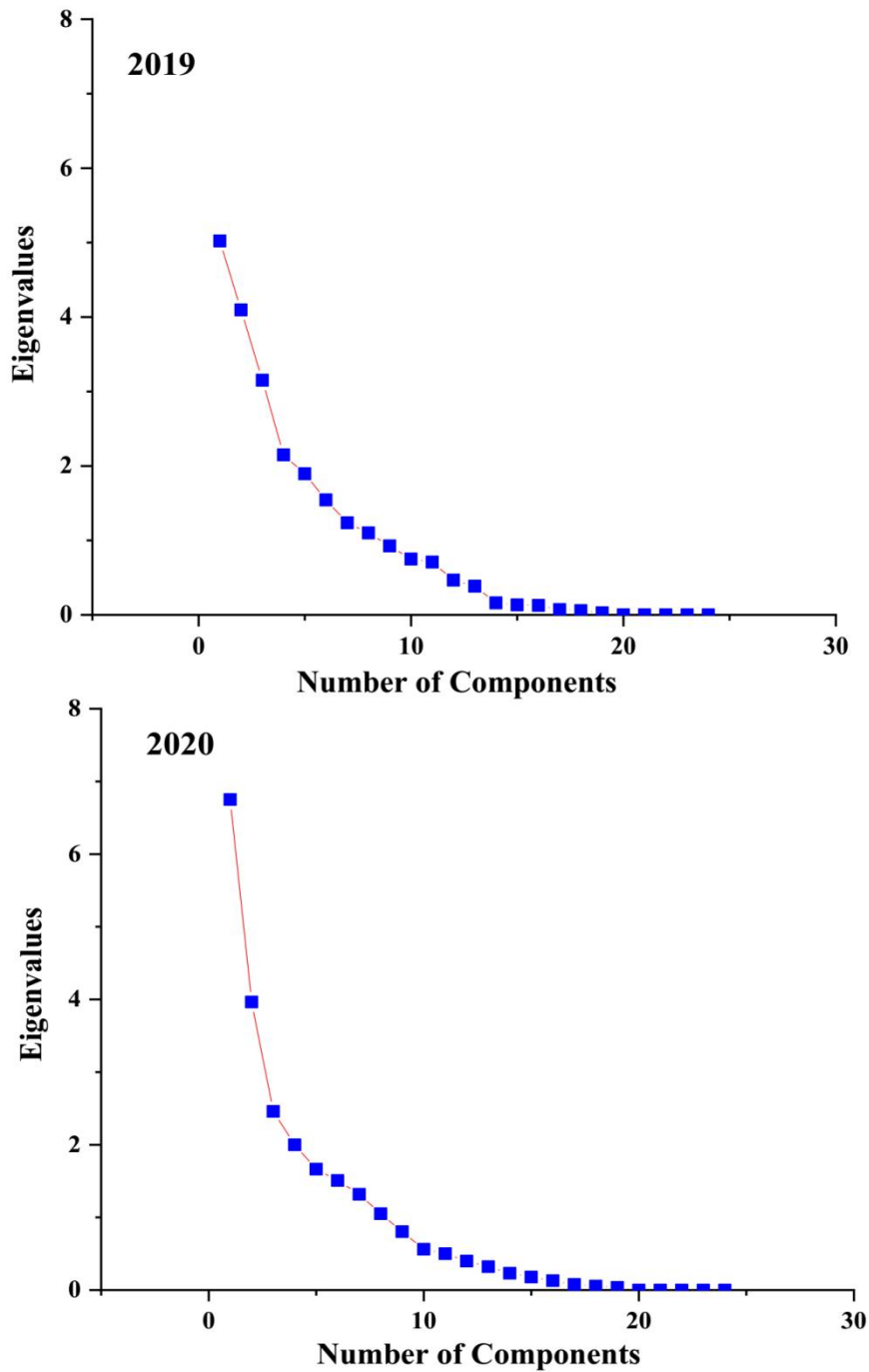
ZnCR, Zn concentration in root; ZnCSh, Zn concentration in shoot



Supplementary Fig. S1. Fe concentration in shoots (top) and roots (bottom) in different combination of three saline levels (S0, 0 g/kg soil; S1, 0.5 g/kg soil; S2, 1.0 g/kg soil) and four P levels (P0, 0 mg/kg soil; P50, 50 mg/kg soil; P120, 120 mg/kg soil; P240, 240 mg/kg soil). Comparisons were made within S0 (red), S1 (gray), and S2 (blue) salinity treatments. Different letters within a salinity treatment indicate significance ($P < 0.05$).



Supplementary Fig. S2. Se concentration in shoots (top) and roots (bottom) in different combination of three saline levels (S0, 0 g/kg soil; S1, 0.5 g/kg soil; S2, 1.0 g/kg soil) and four P levels (P0, 0 mg/kg soil; P50, 50 mg/kg soil; P120, 120 mg/kg soil; P240, 240 mg/kg soil). Comparisons were made within S0 (red), S1 (gray), and S2 (blue) salinity treatments. Different letters within a salinity treatment indicate significance ($P < 0.05$).



Supplementary Fig S3. The first two components of the PCA analysis based on twenty four traits explained 39.59% of the variance for 20 wheat genotypes in the season of 2019 (top), while the first two components of the PCA analysis based on twenty traits explained 44.61% of the variance for 20 wheat genotypes in the season of 2020 (bottom).