

Supplementary materials

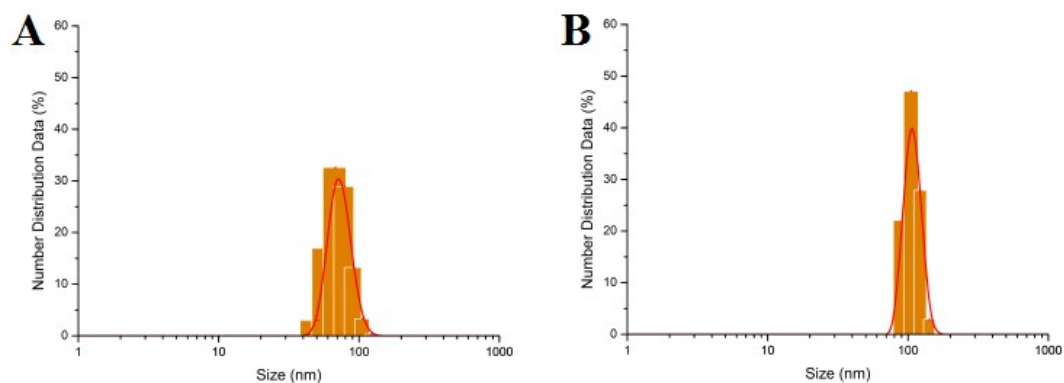


Figure S1. The hydration particle size of the CDs was shown in the particle size histogram. 75 mg/L CDs in 1/4 Hoagland's nutrient solution (A); 75 mg/L CDs and 50 mg/L Cd²⁺ in 1/4 Hoagland's nutrient solution (B).

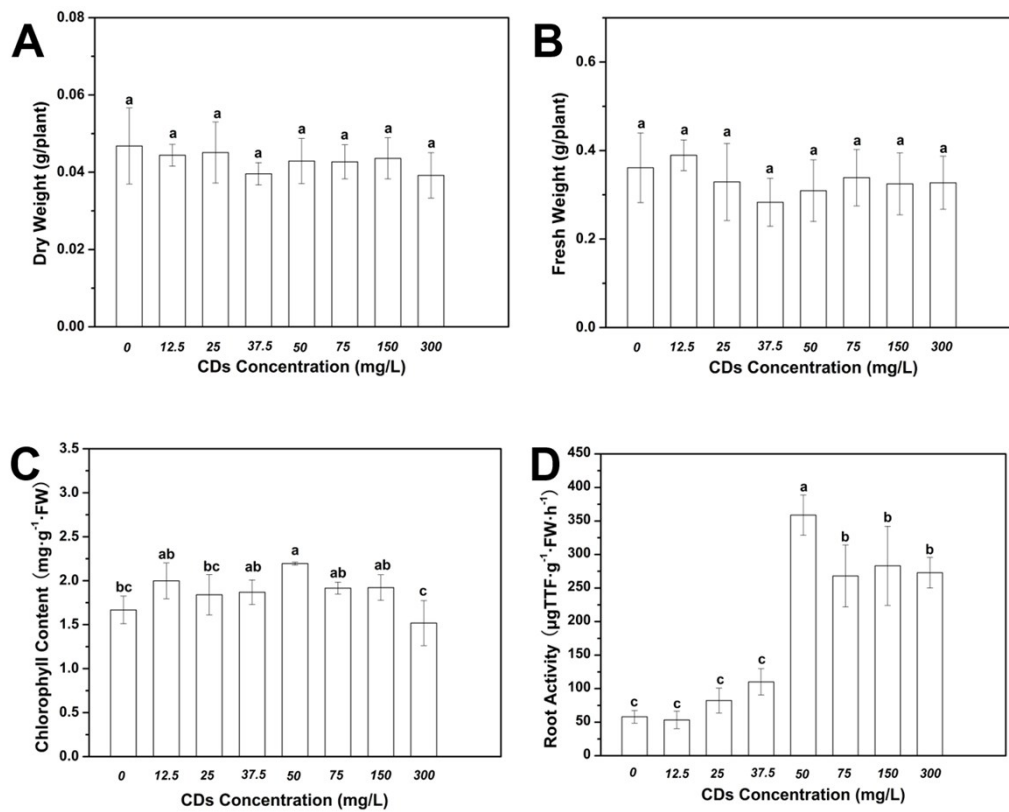


Figure S2. Growth of wheat seedlings that were treated with different concentrations of CDs for 5 days in hydroponic exposure. Data were shown as mean \pm standard deviation of three replicates. Values of dry weight (A), fresh weight (B), chlorophyll content (C) and root activity (D) were labeled with different letters, which indicate the significance levels at $p \leq 0.05$.

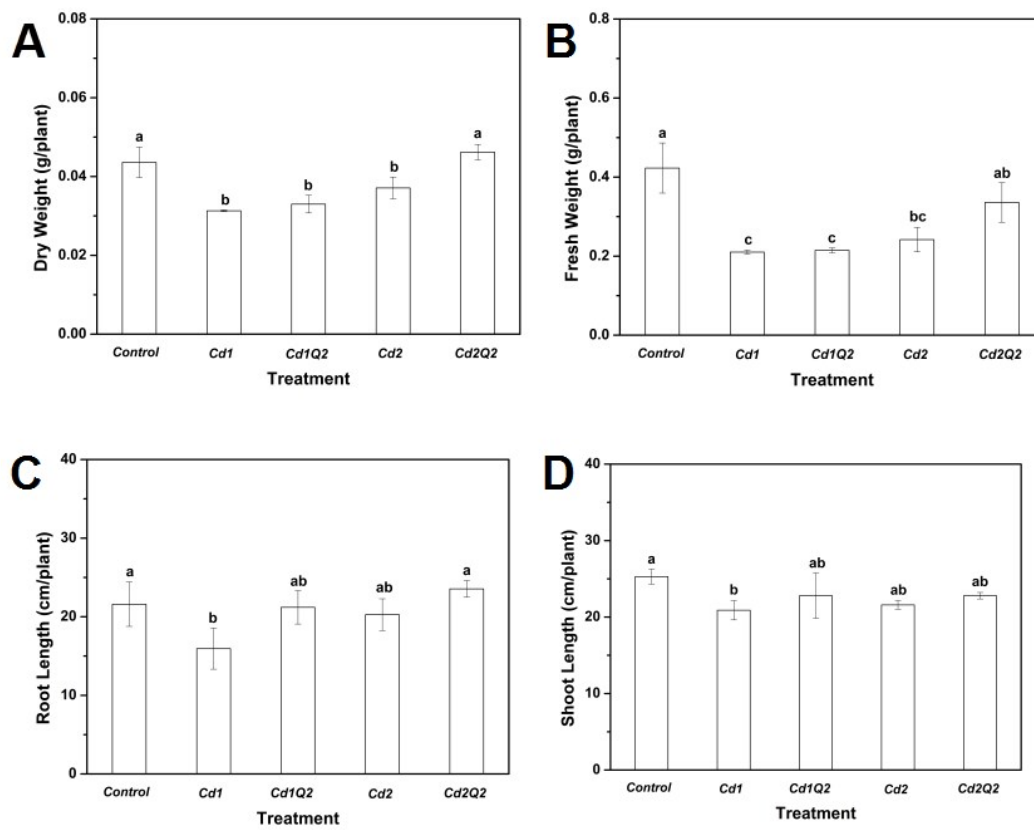


Figure S3. Growth of wheat seedlings that were treated with different concentrations of Cd^{2+} in hydroponic exposure and leaf sprayed 75 mg/L CDs for 5 days. Data were shown as mean \pm standard deviation of three replicates. Values of dry weight (A), fresh weight (B), root length (C) and shoot length (D) were labeled with different letters, which indicate the significance levels at $p \leq 0.05$.

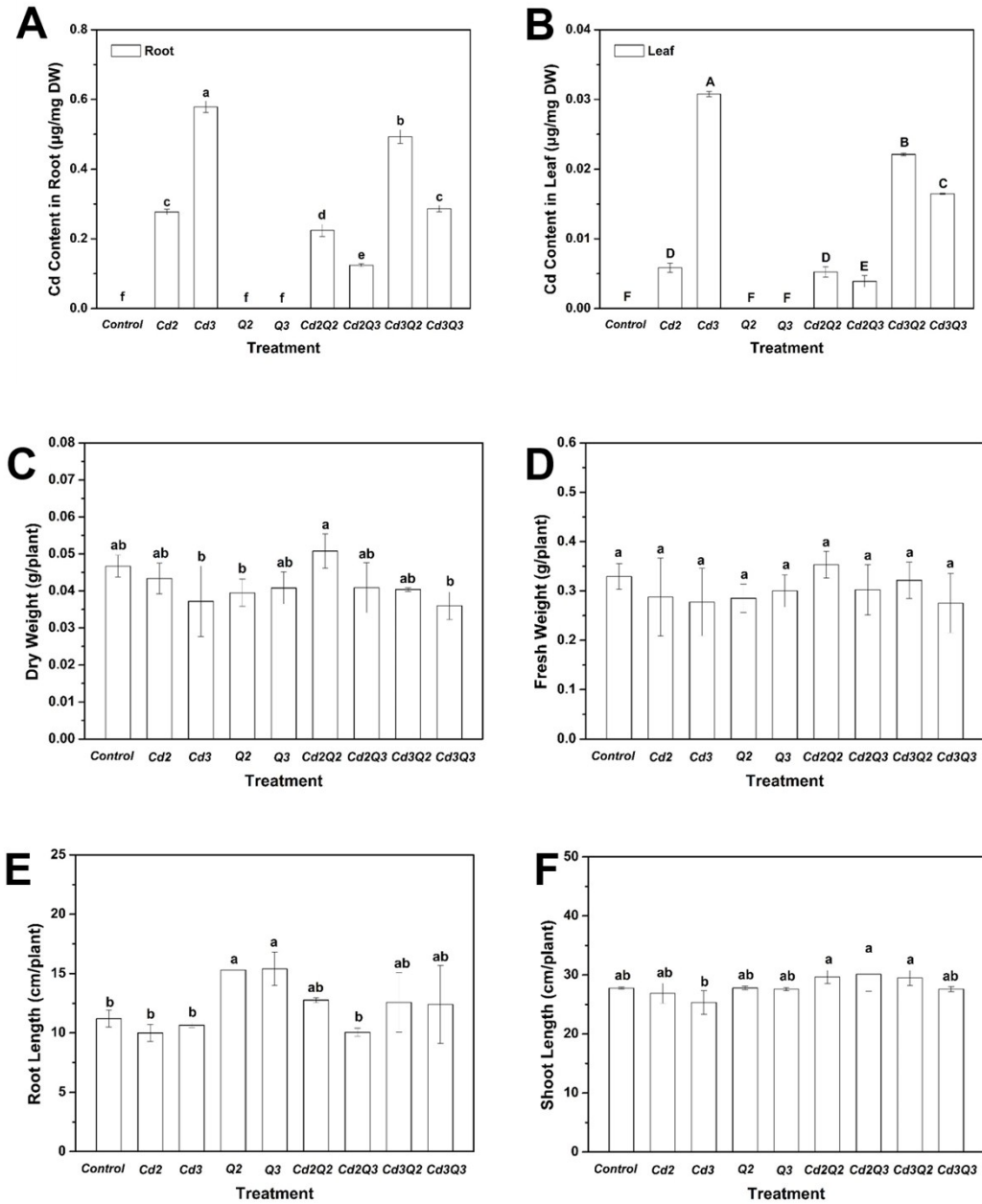


Figure S4. Growth of wheat seedlings that were treated with different concentrations of Cd^{2+} (Cd2: 50 mg/kg, Cd3: 200 mg/kg), CDs (Q2: 75 mg/kg, Q3: 500 mg/kg) and their mixtures in soil. A control without any treatment was set up to compare with different treatments. Cd content in wheat roots (A) and leaves (B), dry weight (C), fresh weight (D), root length (E) and shoot length (F) were recorded. Values labeled with different letters indicate the significance levels at $p \leq 0.05$.

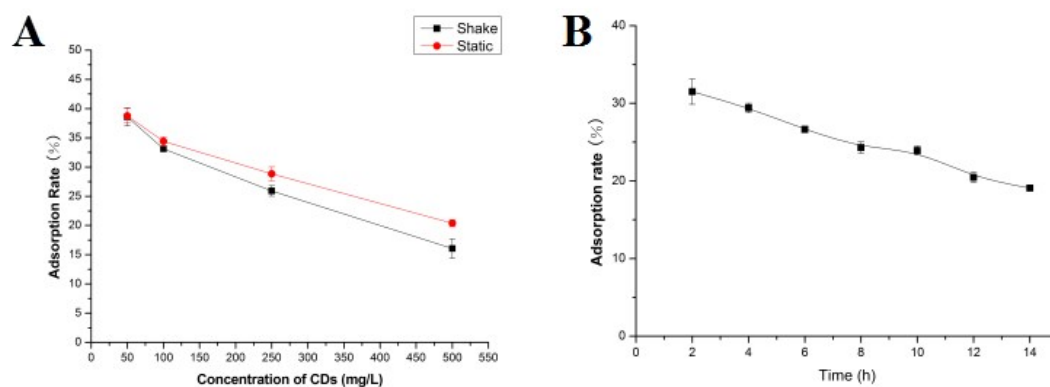


Figure S5. The curve of the rate of Cd^{2+} adsorption by CDs as a function of CDs concentration (A); The curve of the rate of 20 mg/L Cd^{2+} adsorption by 100 mg/L CDs under shaking condition every 2 h (B).

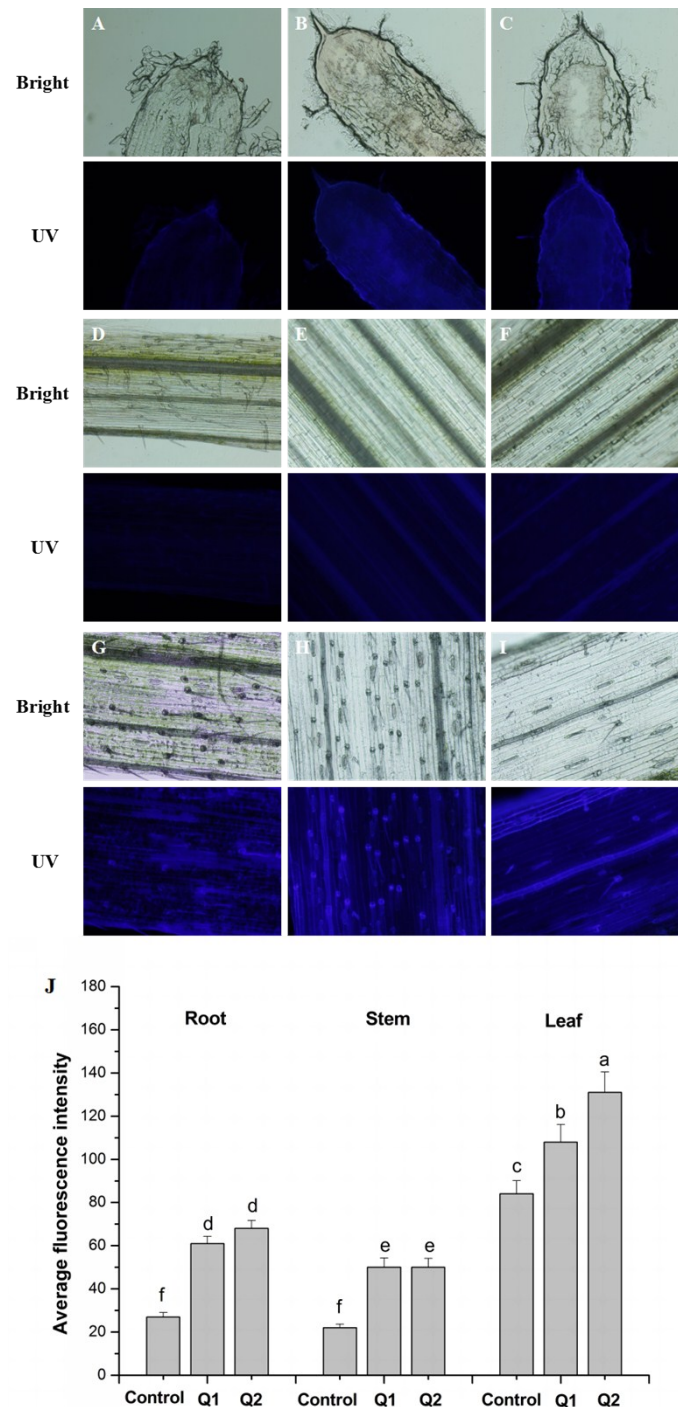


Figure S6. After 5 days in hydroponic exposure, the bright and UV fluorescent images of wheat tissue are shown in the figure below. The images of roots in control, Q1 and Q2 (A-C). The images of stems in control, Q1 and Q2 (D-F). The images of leaves in control, Q1 and Q2 (G-I). Values of fluorescence intensity (J) were labeled with different letters, which indicate the significance levels at $p \leq 0.05$.

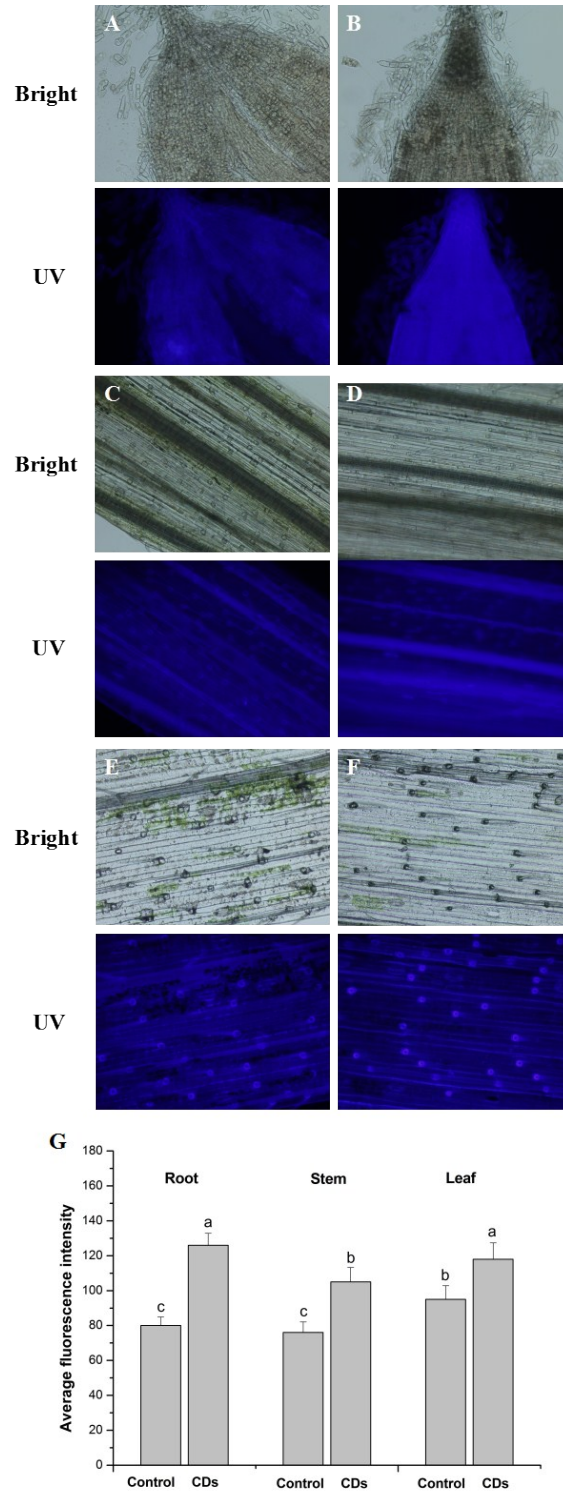


Figure S7. In the leaf spray experiment, the bright and UV fluorescent images of wheat tissue are shown in the figure below. The images of roots in control and leaf sprayed with 75 mg/L CDs (A and B). The images of stems in control and leaf sprayed with 75 mg/L CDs (C and D). The images of leaves in control and leaf sprayed with 75 mg/L CDs (E and F). Values of fluorescence intensity (G) were labeled with different letters, which indicate the significance levels at $p \leq 0.05$.



Figure S8. In the soil culture experiment, the appearance of then wheat seedlings each treatment group was taken.

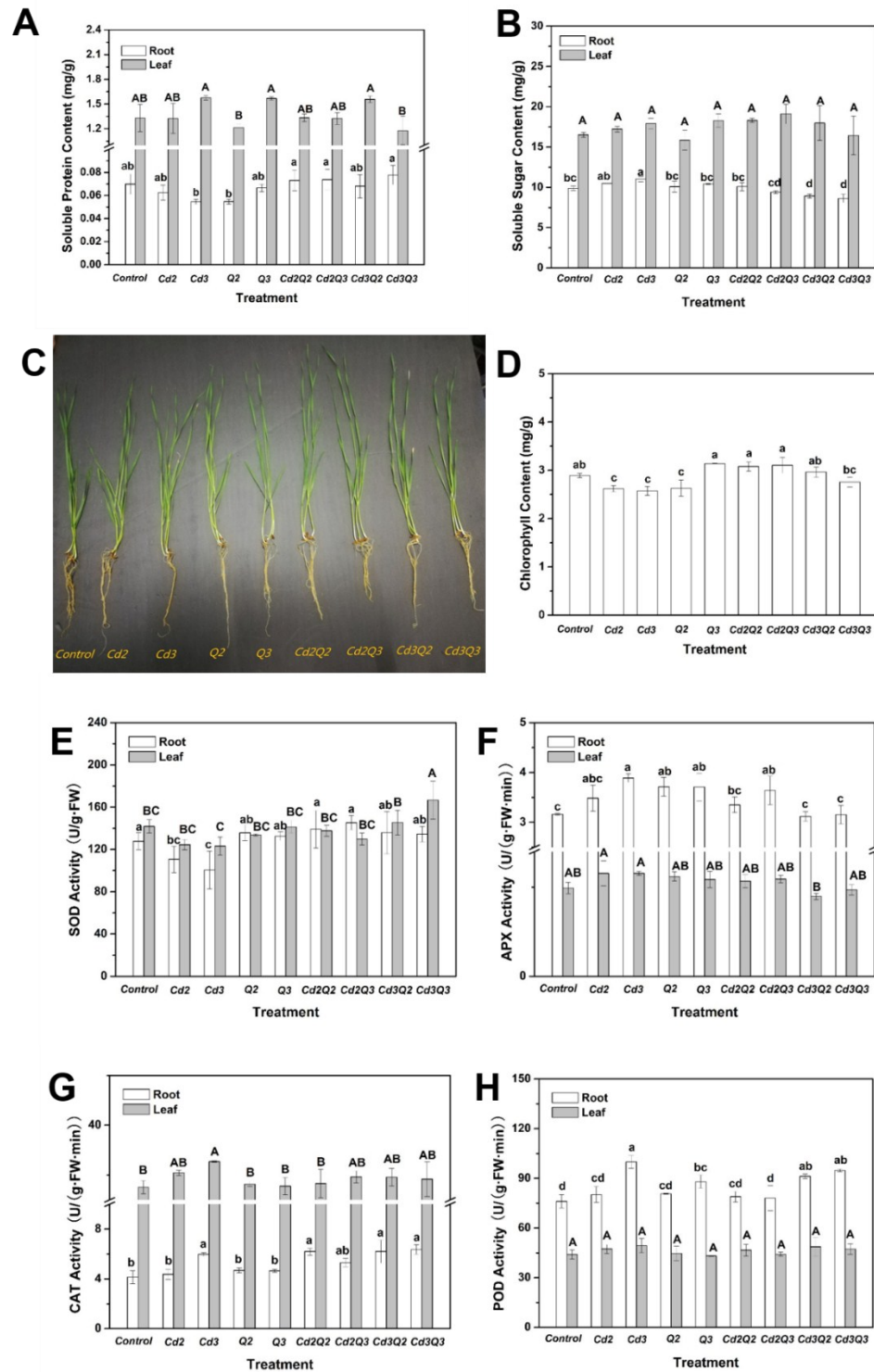


Figure S9. In the soil culture experiment, soluble protein content (A), soluble sugar content (B), wheat growth comparison figure (C), chlorophyll content (D), SOD activity (E), APX activity (F), CAT activity (G) and POD activity (H). The above values were labeled with different letters, which indicate the significance levels at $p \leq 0.05$.