**Supplement figure and tables**



**Figure S1∣**The effect of eCO2 on shoot dry weight at (a) R5 (81 days after sowing) and (b) R8 (120 days after sowing), shoot N concentration at (c) R5 and (d) R8. Error bars are standard errors. The separate vertical bar in each panel indicates the LSD (*P* < 0.05) for the CO2 × cultivar interaction.



**Figure S2∣**Relationship between the increase in seed yield under eCO2 and increases in the amount of (a) fertilizer and (b) soil-derived N in shoot in response to eCO2. Each data point represents one cultivar.



**Figure S3∣**Relationships between the increase in seed yield under eCO2 and increases in (a) total root length, and length of (b) fine roots (0.0－0.5 mm in diameter), (c) intermediate roots (0.5－1.0 mm in diameter), and (d) coarse roots (>1.0 mm in diameter) in response to eCO2. Each data point represents one cultivar.



**Figure S4∣**Relationships between the increase in fixed-N content of shoot at R8 (120 days after sowing) under eCO2 and increases in (a) nodule number, (b) nodule density, (c) nodule fresh weight. Each data point represents one cultivar.

**Table S1∣**Root length among three root-diameter classes of eight soybean cultivars grown under aCO2 or eCO2 at R5 (81 days after sowing)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Total root length  (m plant-1) | |  | | Fine roots length  (m plant-1) | |  | | Intermediate roots length  (m plant-1) | |  | | Coarse roots length  (m plant-1) | |  |
|  | aCO2 | eCO2 | | aCO2 | | eCO2 | | aCO2 | | eCO2 | | aCO2 | | eCO2 | |
| XHJ | 58.8 | 70.3\* | | 41.4 | | 49.8\* | | 11.5 | | 14.1\* | | 6.0 | | 6.4 ns | |
| SN14 | 48.7 | 59.9\* | | 34.8 | | 43.5\* | | 10.5 | | 13.5 ns | | 4.9 | | 5.6 ns | |
| SN8 | 63.6 | 74.0\* | | 45.4 | | 53.5\* | | 9.0 | | 10.8 ns | | 5.9 | | 7.0 ns | |
| HN45 | 55.5 | 61.0\* | | 39.8 | | 44.4\* | | 12.2 | | 13.6 ns | | 4.9 | | 5.3 ns | |
| SN22 | 64.3 | 66.4 ns | | 47.9 | | 46.9ns | | 10.8 | | 11.3 ns | | 5.4 | | 6.6\* | |
| HJ6 | 52.5 | 72.8\* | | 37.1 | | 52.2\* | | 11.0 | | 12.8 ns | | 4.8 | | 7.2 ns | |
| NF9 | 51.9 | 59.8\* | | 37.1 | | 43.8\* | | 10.6 | | 10.6 ns | | 4.2 | | 5.5 ns | |
| NF1 | 57.1 | 62.3\* | | 40.2 | | 43.0\* | | 11.9 | | 12.2 ns | | 5.0 | | 7.1\* | |
| LSD0.05 | 4.46 | | | 3.28 | | | | 1.72 | | | | 1.81 | | | |
| *Significant level* |  |  | |  | |  | |  | |  | |  | |  | |
| CO2 | <0.001 | | | <0.001 | | | | <0.001 | | | | <0.001 | | | |
| Cultivar | <0.001 | | | <0.001 | | | | <0.001 | | | | 0.133 | | | |
| CO2×Cultivar | 0.001 | | | <0.001 | | | | 0.156 | | | | 0.697 | | | |

Fine roots (0.0－0.5 mm in diameter); Intermediate roots (0.5－1.0 mm in diameter); Coarse roots (>1.0 mm in diameter). \* and ns indicate significant and non-significant differences (*t* test) between aCO2 and eCO2 of individual genotypes, respectively, for individual cultivars. LSD values correspond to the CO2 × cultivar interaction (two-way ANOVA).

**Table S2∣**Fertilizer- and soil-derived, and total N uptake per unit of root length for eight soybean cultivars grown for 120 days (R8) under aCO2 or eCO2

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | N uptake by root  (mg m-1) | |  | | Fertilizer N uptake by root  (mg m-1) | |  | | Soil N uptake by root  (mg m-1) | |
|  | aCO2 | eCO2 | | aCO2 | | eCO2 | | aCO2 | | eCO2 |
| XHJ | 3.03 | 3.93\* | | 1.95 | | 2.37 ns | | 1.08 | | 1.56\* |
| SN14 | 3.21 | 3.65\* | | 2.00 | | 2.12 ns | | 1.21 | | 1.53\* |
| SN8 | 3.14 | 3.07 ns | | 1.98 | | 1.80 ns | | 1.16 | | 1.27\* |
| HN45 | 3.29 | 3.73\* | | 2.09 | | 2.18 ns | | 1.2 | | 1.55\* |
| SN22 | 2.50 | 2.90\* | | 1.59 | | 1.70 ns | | 0.91 | | 1.20\* |
| HJ6 | 2.82 | 2.97 ns | | 1.76 | | 1.73 ns | | 1.06 | | 1.24\* |
| NF9 | 3.92 | 3.76 ns | | 2.47 | | 2.17\* | | 1.44 | | 1.58\* |
| NF1 | 2.69 | 3.34\* | | 1.68 | | 1.94\* | | 1.01 | | 1.41\* |
| LSD0.05 | 0.32 | | | 0.22 | | | | 0.11 | | |
| *Significant level* |  |  | |  | |  | |  | |  |
| CO2 | <0.001 | | | 0.106 | | | | <0.001 | | |
| Cultivar | <0.001 | | | <0.001 | | | | <0.001 | | |
| CO2×Cultivar | <0.001 | | | 0.001 | | | | <0.001 | | |

\* and ns indicate significant and non-significant differences (*t* test) between aCO2 and eCO2, respectively, for individual cultivars. LSD values correspond to the CO2 × cultivar interaction (two-way ANOVA).