**Supplemental Table S1.** The levels of endogenous hormones during soybean seed development.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Accession** | **Stage** | **ABA (nmol gdwt-1)** | **NT (pmol gdwt-1)** | | | | **RB (pmol gdwt-1)** | | | | **MeSZ (pmol gdwt-1)** | **Gluc (pmol gdwt-1)** | | | | | |
| **DZNT** | ***t*ZNT** | ***c*ZNT** | **iPNT** | **DZR** | ***t*ZR** | ***c*ZR** | **iPR** | **DZOG** | **DZROG** | **DZ9G** | ***t*ZROG** | ***t*Z9G** | ***c*ZROG** |
| **T1** | ***R5*** | 72.3a\* | 7.51c | 10.97c | 14.13b | 20.82a | 10.52\*a | 4.28a | 0.4a | 12.60a | 82.28a | 4.17\*a | 230.22a | 6.80a | 3.83a | 29.5a | 7.51a |
| ***R6*** | 25.97b | N/D | N/D | 18.82a | 27.27a | 1.27b | N/D | N/D | 10.45a | 48.70a | 2.58a | 39.76b | 6.50a | N/D | 31.01a | N/D |
| ***R7*** | 7.46c | N/D | N/D | 30.95a | 17.71a | 1.55b | N/D | N/D | 4.06b | 56.76a | 2.22a | 23.19b | 3.94a | N/D | 18.67b | N/D |
| ***R8*** | 0.25c | N/D | N/D | 9.54c | 10.20a | 0.67b | N/D | N/D | 3.10b | 19.80a | 2.78a | 4.83b | 3.72a | N/D | 12.49b | N/D |
| **T2** | ***R5*** | 109.06a | 7.24c | 9.53c | 26.64a | 17.29a | 20.51a | 5.63a | 0.45a | 26.05a | 42.76a | 11.80a | 332.24a | 18.37a | 8.53a | 100.29a | 15.04a |
| ***R6*** | 69.37b | N/D | N/D | 25.62a | 15.91a | 2.40b | 1.91b | N/D | 17.25ab | 35.97a | 2.84b | 13.68b | 6.40bc | N/D | 34.55b | N/D |
| ***R7*** | 6.19c | N/D | N/D | 14.77b | 21.86a | 1.20b | N/D | N/D | 7.13b | 42.27a | 1.81b | 5.48b | 7.03b | N/D | 20.75c | N/D |
| ***R8*** | 0.43c | N/D | N/D | 11.56b | 8.25b | 0.89b | N/D | N/D | 4.02b | 24.22a | 1.32b | 6.33b | 4.46c | N/D | 11.99c | N/D |
| **T5** | ***R5*** | 65.39a | 11.36b | 44.19a | 18.70a | 22.21a | 31.13a | 18.41a | N/D | 21.87a | 41.33a | 8.54a | 1037.17a | 12.48a | 15.19a | 41.56a | 22.6a |
| ***R6*** | 43.74b | N/D | N/D | 16.81a | 16.42a | 1.38b | 2.17b | N/D | 8.99b | 34.78a | 4.67b | 19.28b | 9.22a | N/D | 16.24b | N/D |
| ***R7*** | 1.70c | N/D | N/D | 11.86b | 17.43a | 1.16b | N/D | N/D | 5.26c | 29.23ab | 6.47ab | 26.05b | 9.02a | N/D | 6.48b | N/D |
| ***R8*** | 0.52c | N/D | N/D | 6.78c | 7.88b | 0.92b | N/D | N/D | 2.53d | 13.94b | 3.76b | 7.23b | 6.48a | N/D | 4.29b | N/D |
| **T6** | ***R5*** | 119.23a | 15.56a | 25.44b | 41.41a | 19.83a | 52.84a | 15.49a | 0.98a | 65.57a | 24.67a | 17.52a | 1353.61a | 23.93a | 25.22a | 25.20a | 44.19a |
| ***R6*** | 49.96b | N/D | 10.56c | 15.71b | 21.47a | 1.60b | 2.10b | N/D | 18.04b | 30.19a | 5.76b | 16.45b | 8.19b | 1.77b | 7.41b | N/D |
| ***R7*** | 1.55c | N/D | N/D | 16.94b | 16.15a | 1.08b | N/D | N/D | 6.42c | 18.77a | 3.44b | 6.33b | 5.13bc | N/D | 4.88b | N/D |
| ***R8*** | 0.62c | N/D | N/D | 7.79c | 8.18b | 0.62b | N/D | N/D | 3.88c | 13.00a | 1.72b | 5.54b | 3.04c | N/D | 4.31b | N/D |
| **T7** | ***R5*** | 56.87a | N/D | N/D | 79.3a | 15.15b | 5.62a | 6.41a | 5.40a | 55.77a | 22.40a | 5.41a | 110.91a | 8.71a | 10.9a | 8.20a | 12.49a |
| ***R6*** | 46.35b | N/D | N/D | 20.24b | 29.8a | 2.81b | 2.25b | 1.69b | 23.78b | 24.92a | 3.98ab | 29.69b | 6.17a | N/D | 7.02a | N/D |
| ***R7*** | 2.90c | N/D | N/D | 16.02b | 16.90b | 0.97c | N/D | 1.46b | 5.51bc | 23.85a | 2.49b | 11.63b | 4.21a | N/D | 4.74a | N/D |
| ***R8*** | 0.38c | N/D | N/D | 5.83c | 6.25c | 0.99c | N/D | 0.89c | 3.14c | 13.55b | 2.09b | 4.29b | 3.85a | N/D | 5.50a | N/D |
| **T12** | ***R5*** | 53.33a | N/D | N/D | N/D | 32.38a | 4.67a | 5.26a | 1.45a | 55.09a | 11.12a | 4.63a | 53.57a | 7.10a | 6.23a | 8.37a | 6.79a |
| ***R6*** | 44.29a | N/D | N/D | N/D | 85.58a | 3.30ab | 3.21b | 1.68a | 40.24b | 9.37a | 4.27a | 27.93a | 5.52a | 1.39b | 9.40a | N/D |
| ***R7*** | 18.19b | N/D | N/D | N/D | 60.99a | 1.27bc | N/D | 1.61a | 12.14c | 7.00a | 3.39a | 19.24a | 5.00a | N/D | 3.67a | N/D |
| ***R8*** | 0.68c | N/D | N/D | N/D | 8.99a | 0.38c | N/D | 1.19a | 3.71c | 10.60a | 2.68a | 21.09a | 3.92a | N/D | 7.24a | N/D |

**\***Different letters within a column for each accession indicate significant differences at p<0.05 detected by Duncan’s multiple range test.

**Supplemental Table S2.** The levels of fatty acids (FA; μmol gdwt-1) and oil content (%) during soybean seed development.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Accession** | **Stage** | **C16:0** | **C18:0** | **C18:1** | **C18:2** | **C18:3** | **Oil** |
| **T1** | ***R5*** | 58.60\*d | 16.29b | 116.93d | 224.72d | 105.01c | 14.13d |
| ***R6*** | 61.87c | 14.93c | 127.05c | 288.90c | 99.99d | 17.02c |
| ***R7*** | 85.42a | 18.68a | 178.39a | 374.97a | 117.79a | 20.83a |
| ***R8*** | 73.16b | 13.59d | 157.82b | 328.22b | 111.70b | 18.12b |
| **T2** | ***R5*** | 59.12a | 14.85b | 90.35d | 255.33c | 116.92a | 15.47d |
| ***R6*** | 73.87a | 15.90b | 124.58c | 295.96b | 106.48b | 17.22c |
| ***R7*** | 86.05a | 16.18b | 167.02b | 380.53a | 120.86a | 20.62a |
| ***R8*** | 128.44a | 23.09a | 206.97a | 300.27b | 46.79c | 18.83b |
| **T5** | ***R5*** | 54.50c | 12.12c | 130.71d | 163.72c | 97.01c | 12.38d |
| ***R6*** | 54.37c | 11.69c | 235.52a | 165.59c | 85.46d | 14.77c |
| ***R7*** | 82.83b | 15.72b | 151.35c | 344.12b | 116.09b | 18.80b |
| ***R8*** | 91.17a | 17.08a | 167.20b | 383.36a | 136.37a | 20.94a |
| **T6** | ***R5*** | 46.15d | 10.71c | 91.38d | 115.24d | 73.19d | 9.45d |
| ***R6*** | 65.79c | 14.02b | 158.68a | 216.93c | 103.19c | 16.11c |
| ***R7*** | 85.67b | 17.23a | 132.46c | 353.82b | 116.82b | 19.35b |
| ***R8*** | 90.76a | 18.55a | 141.76b | 375.26a | 125.71a | 20.78a |
| **T7** | ***R5*** | 54.53c | 13.09b | 133.97d | 158.07c | 92.86b | 12.80c |
| ***R6*** | 58.97b | 14.09b | 146.61c | 231.65b | 99.88b | 16.07b |
| ***R7*** | 77.28a | 16.80a | 168.54a | 342.76a | 110.65a | 21.12a |
| ***R8*** | 77.63a | 17.16a | 155.83b | 335.36a | 117.76a | 20.17a |
| **T12** | ***R5*** | 66.10d | 21.55d | 90.69d | 324.62d | 94.99c | 16.78c |
| ***R6*** | 79.43c | 23.73c | 111.49c | 412.61c | 118.02b | 19.89b |
| ***R7*** | 96.06b | 24.95b | 128.57b | 461.87b | 118.65b | 22.78a |
| ***R8*** | 102.14a | 26.09a | 144.59a | 474.31a | 124.58a | 23.44a |

**\***Different letters within a column for each accession indicate significant differences at p<0.05 detected by Duncan’s multiple range test.

**Supplemental Table S3.** The correlation coefficients derived from PCA analysis of the combining hormone and FA data sets of all four stages. Only coefficients equal to or larger than 0.5, are presented.



**Supplemental Table S4.** The gene expression levels in different reproductive organs (FPKM) of ABA and CK related genes expressed during different reproductive stages. All gene expression data is derived from Phytozome 12 (Goodstein et al. 2012) and Le et al. (2012).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Group | Genes | Alias | Gene expression levels in different reproductive organs (FPKM) | | |
| Flower | Pod | Seed (R5) |
| CK\_IPTs | *GmIPT01* | Glyma10g41990 | 0.13 | 0.74 | 0.23 |
| *GmIPT02* | Glyma11g19330 | 3.46 | 2.65 | 3.51 |
| *GmIPT03* | Glyma12g09140 | 0.07 | 0.32 | 0.06 |
| *GmIPT04* | Glyma03g30850 | 0.13 | 0.24 | 0.11 |
| *GmIPT05* | Glyma10g03060 | Not expressed | 0.08 | Not expressed |
| *GmIPT06* | Glyma02g16750 | 0.09 | 0.09 | Not expressed |
| *GmIPT07* | Glyma19g33680 | 0.18 | 0.01 | Not expressed |
| *GmIPT08* | Glyma17g02080 | 0.12 | Not expressed | Not expressed |
| *GmIPT09* | Glyma15g11040 | Not expressed | 0.28 | 0.05 |
| *GmIPT10* | Glyma07g38620 | Not expressed | Not expressed | Not expressed |
| *GmIPT11* | Glyma18g53460 | 0.06 | 11.27 | 4.00 |
| *GmIPT12* | Glyma08g48020 | Not expressed | Not expressed | Not expressed |
| *GmIPT13* | Glyma13g27990 | 0.07 | 5.85 | Not expressed |
| *GmIPT14* | Glyma13g34680 | 1.28 | 1.99 | 2.46 |
|  |  |  |  |  |  |
| CK\_CKXs | *GmCKX01* | Glyma19g31620 | 0.36 | 0.42 | Not expressed |
| *GmCKX02* | Glyma03g28910 | 0.63 | 0.62 | 0.01 |
| *GmCKX03* | Glyma09g07190 | 0.02 | 1.88 | 1.14 |
| *GmCKX04* | Glyma09g07360 | 18.13 | 0.29 | 0.08 |
| *GmCKX05* | Glyma13g16420 | 0.11 | Not expressed | Not expressed |
| *GmCKX06* | Glyma13g16430 | 0.64 | 0.14 | Not expressed |
| *GmCKX07* | Glyma15g18560 | 9.09 | 1.84 | 1.19 |
| *GmCKX08* | Glyma17g06220 | 15.89 | 7.66 | 1.08 |
| *GmCKX09* | Glyma17g06230 | Not expressed | Not expressed | Not expressed |
| *GmCKX10* | Glyma06g03180 | 0.05 | 0.08 | 0.35 |
| *GmCKX11* | Glyma04g03130 | 0.22 | 0.04 | 0.11 |
| *GmCKX12* | Glyma09g35950 | 14.37 | 1.39 | 0.12 |
| *GmCKX13* | Glyma11g20860 | 0.01 | 0.20 | 1.23 |
| *GmCKX14* | Glyma12g01390 | 0.92 | 0.22 | 0.01 |
| *GmCKX15* | Glyma04g05840 | 0.23 | 1.57 | 0.76 |
| *GmCKX16* | Glyma14g11280 | 32.37 | 3.87 | 1.03 |
| *GmCKX17* | Glyma17g34330 | 2.17 | 7.44 | 1.88 |
|  |  |  |  |  |  |
| ABA | *GmABI3\_1* | Glyma08g47240 | 0.08 | 6.85 | 131.35 |
| *GmABI3\_2* | Glyma18g38490 | 0.15 | 4.19 | 80.08 |
| *AREB3-1* | Glyma04g14840 | 0.27 | 3.64 | 13.29 |
| *AREB3-2* | Glyma06g47220 | 1.53 | 5.58 | 19.26 |
| *LEC1-1* | Glyma07g39820 | 0.08 | 8.50 | 48.57 |
| *LEC1-2* | Glyma17g00950 | 0.28 | 19.48 | 142.83 |
| *bZIP67* | Glyma13g39340 | 0.02 | 0.77 | 21.33 |
| *FUS3\_1* | Glyma.20G035700 | 0.00 | 0.12 | 0.00 |
| *FUS3\_2* | Glyma19g27336 | 0.03 | 2.05 | 13.27 |
| *FUS3\_3* | Glyma20g04761 | 0.00 | 0.03 | 0.00 |
| *FUS3\_4* | Glyma16g05480 | 0.02 | 1.27 | 11.37 |