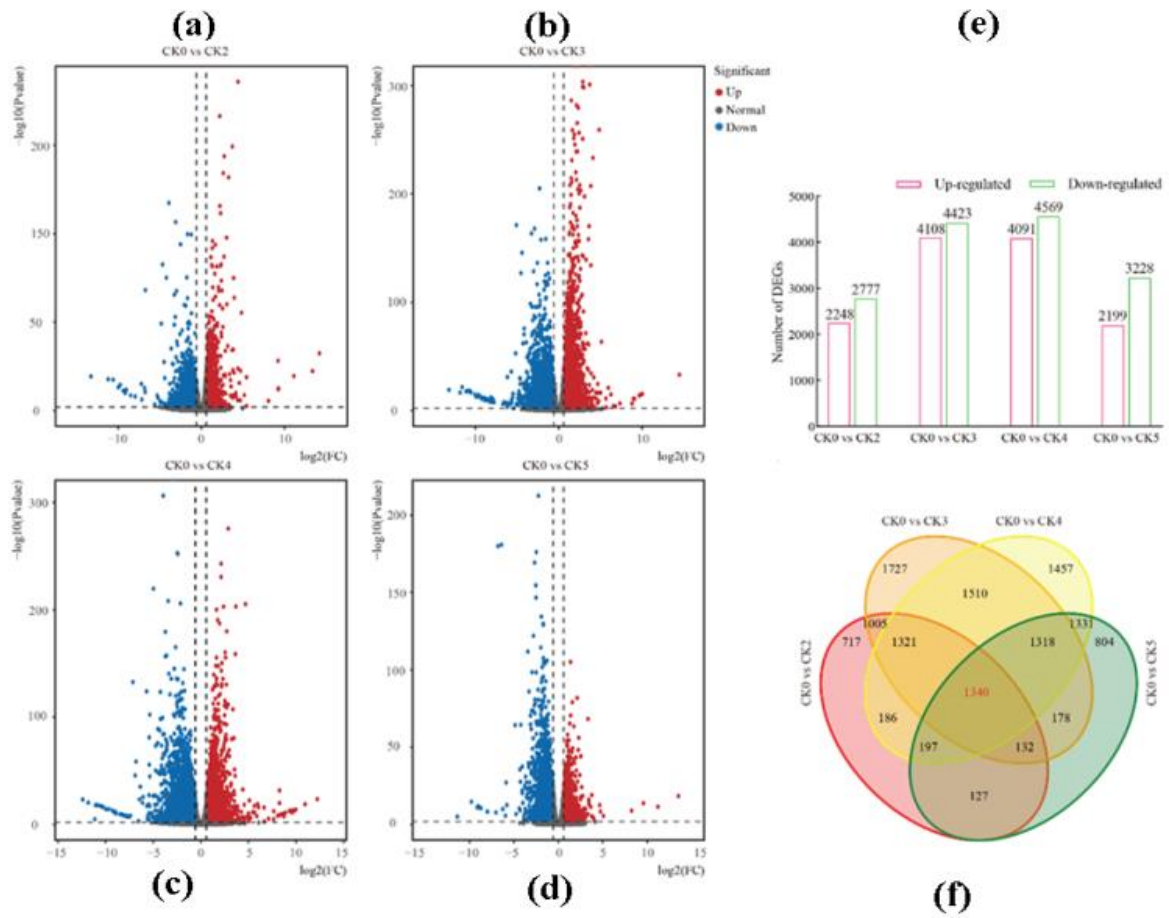
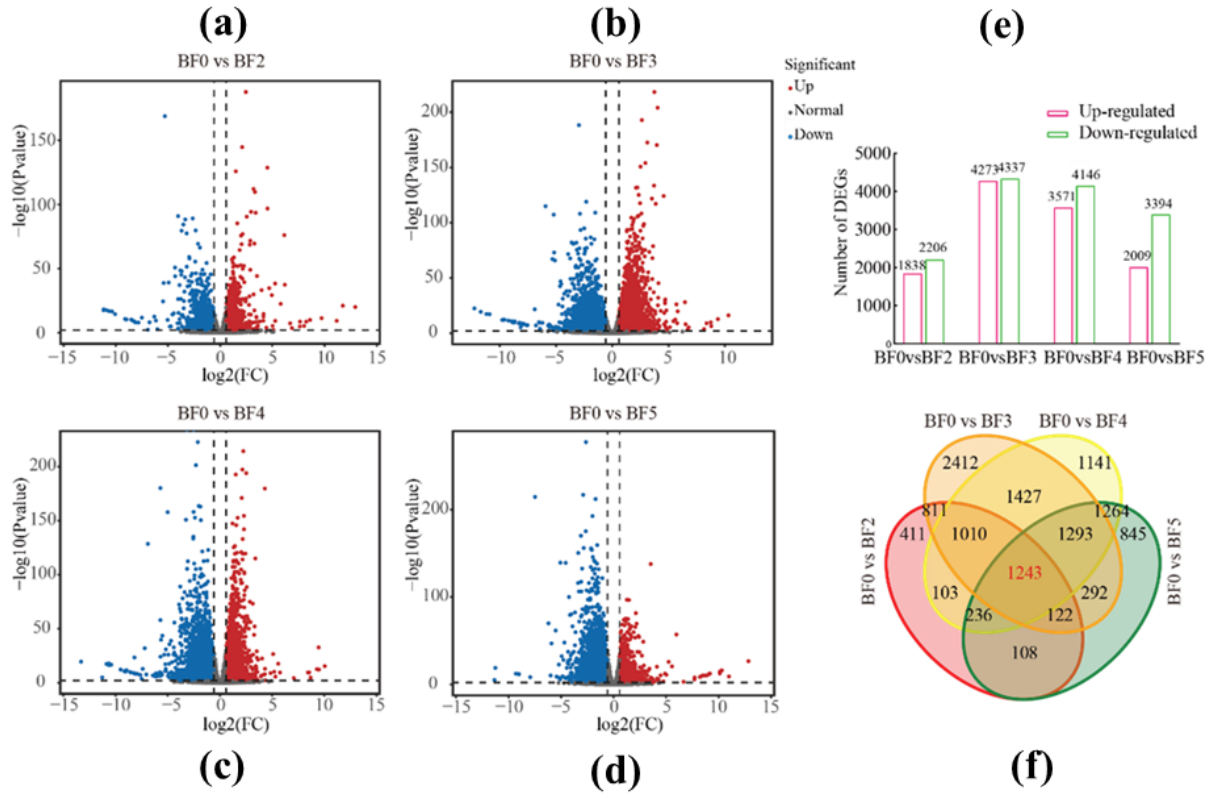


## Supplementary Figures

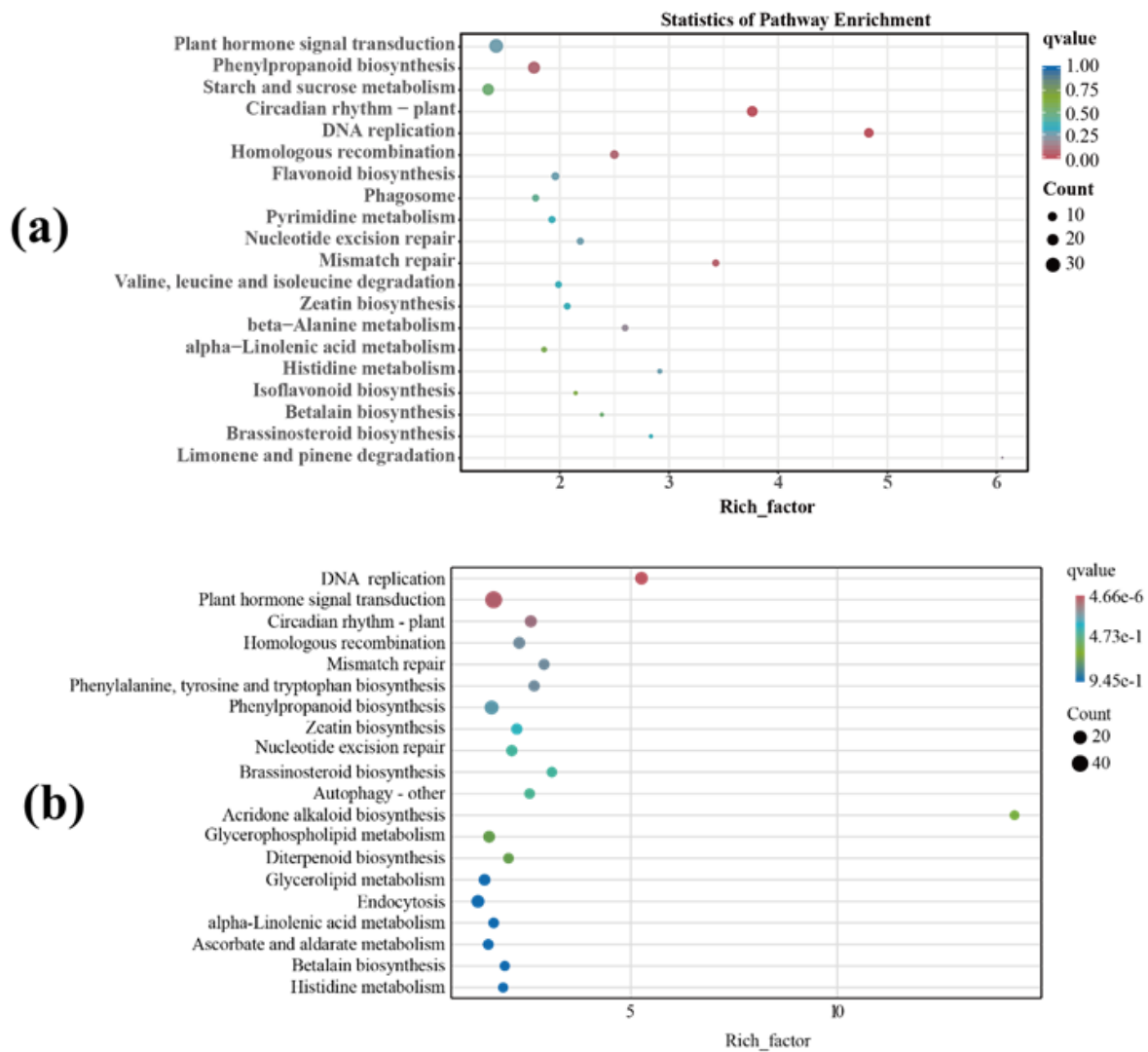


**Supplementary Figure S1:** Differential gene expression distribution in flower spikes in control groups under low-temperature conditions. Here, (a–d) indicate differential expression volcano plots comparison among CK0 (0d) vs CK2 (2d), CK0 (0d) vs CK3 (3d), CK0 (0d) vs CK4 (4d), and CK0 (0d) vs CK5 (5d), respectively. Where (e) indicates the histogram, and (f) indicates the Venn diagram of the number of DEGs in the CK groups.

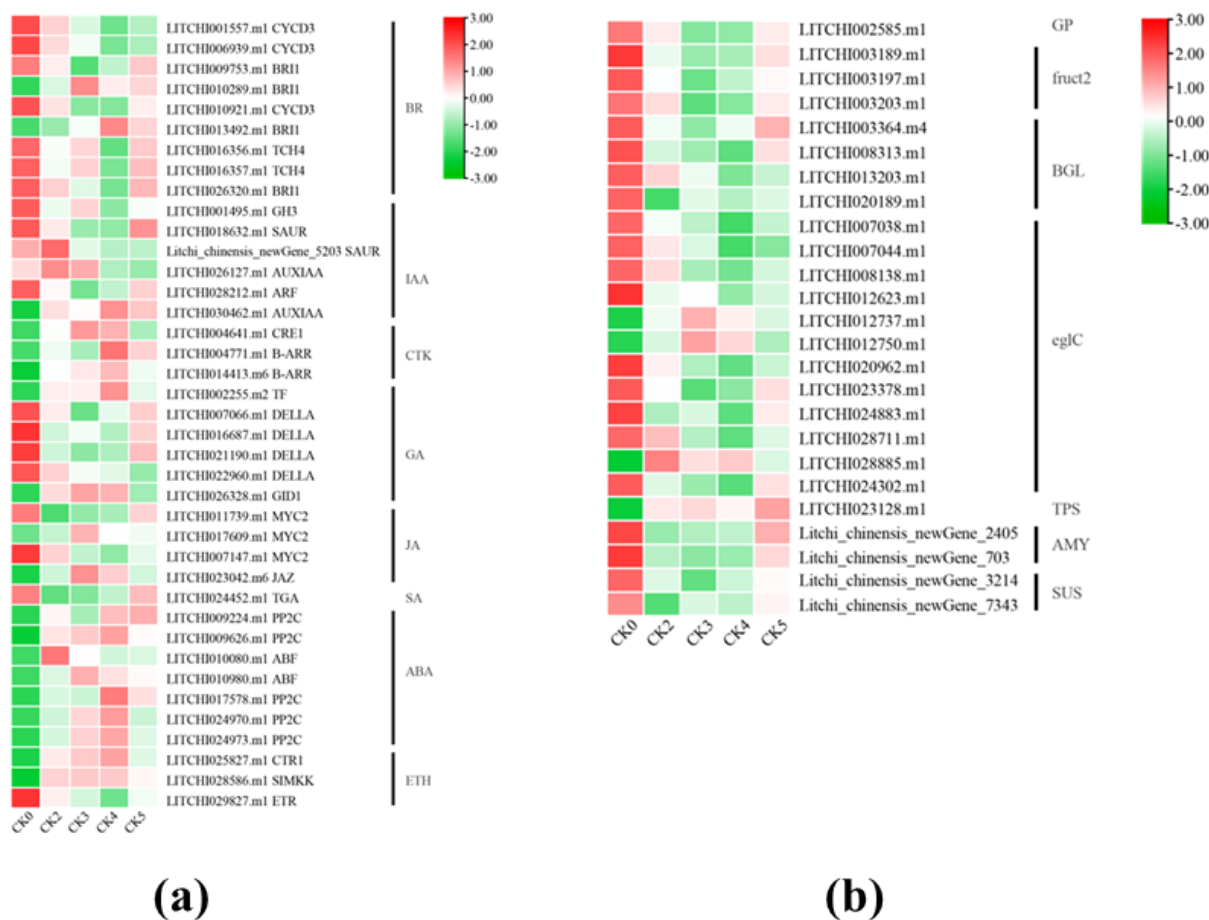


**Supplementary Figure S2:** Differential gene expression distribution in flower spikes under low temperature conditions in Bihu treatment groups. Here, (a–d) indicate differential expression volcano plots comparison among BF0 (0d) vs BF2 (2d), BF0 (0d) vs BF3 (3d), BF0 (0d) vs BF4 (4d), and BF0 (0d) vs BF5 (5d), respectively. Where (e) indicates the histogram, and (f) indicates the Venn diagram of the number of DEGs in the BF groups.

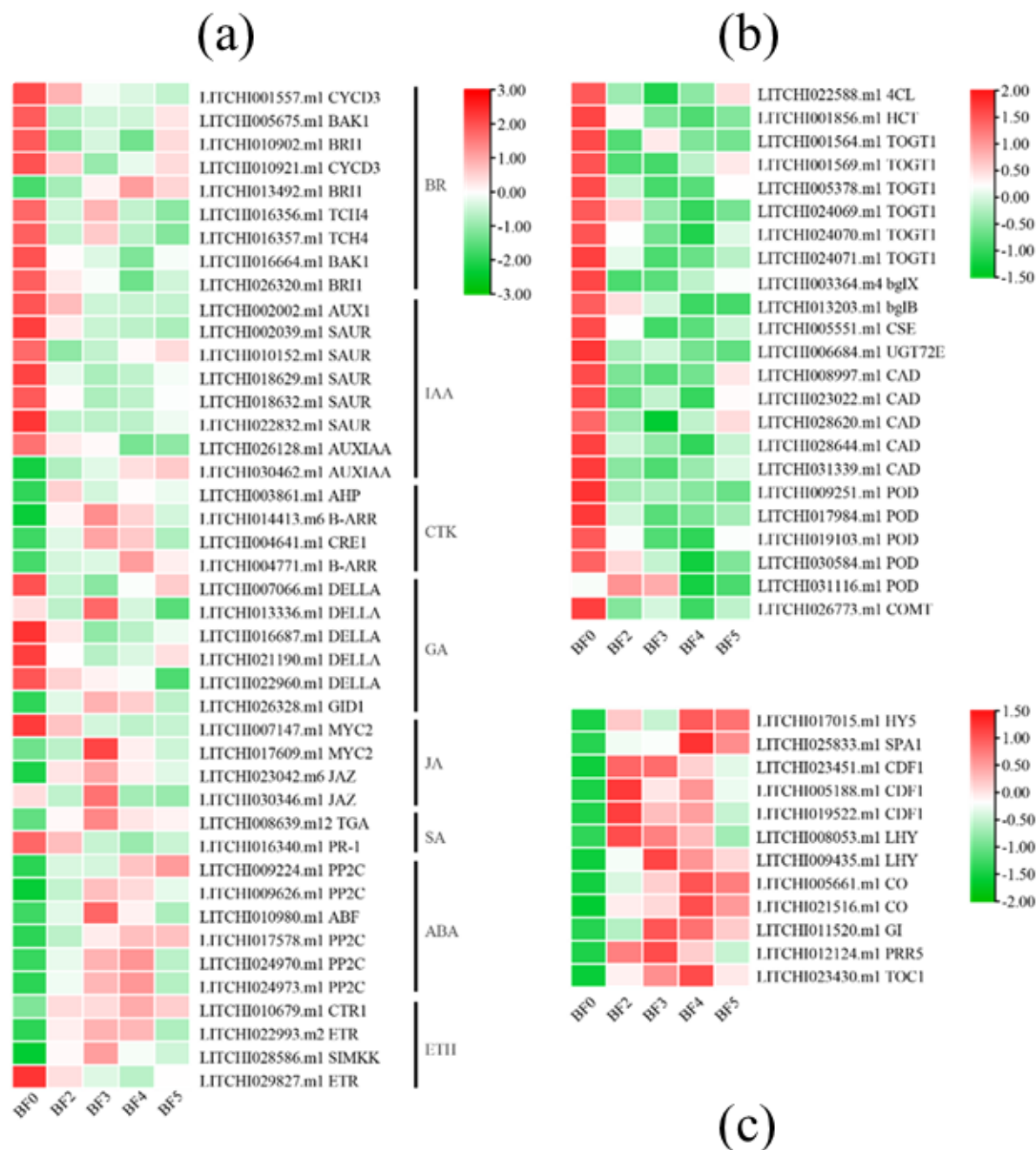




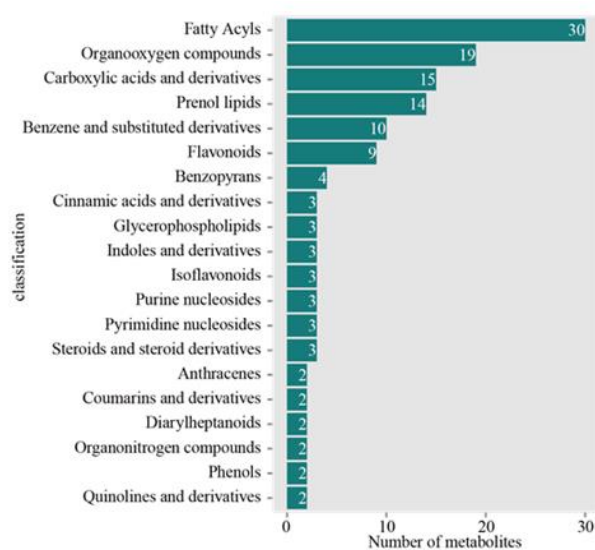
**Supplementary Figure S4:** KEGG classification map of low-temperature response genes in flower spikes. Here, (a) indicates the KEGG classification map in CK groups, and (b) indicates the KEGG classification map in BF groups.



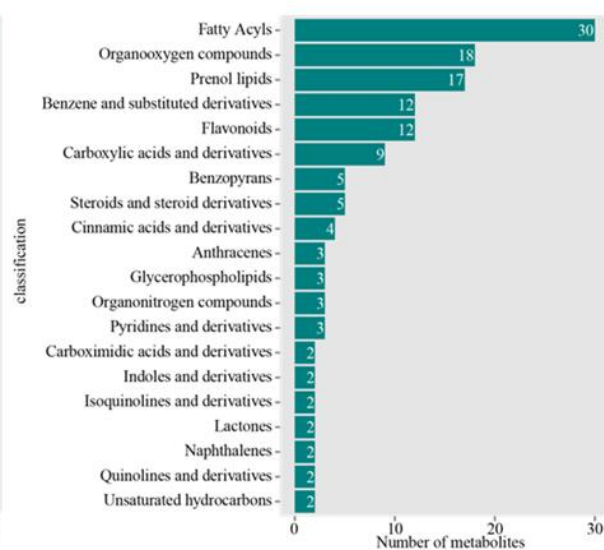
**Supplementary Figure S5:** Heat map of plant growth regulator candidate gene enrichment pathways in CK groups under low temperature. Here, (a) indicates plant hormone signal transduction and (b) indicates starch and sucrose metabolism.



**Supplementary Figure S6:** Heat map of plant growth regulator candidate gene enrichment pathways in BF groups under low temperature. Here, (a) indicates a heat map of growth regulator candidate genes enriched to plants' hormone signal transduction, (b) indicates a heat map of growth regulator candidate genes enriched to phenylpropanoid biosynthesis, and (c) indicates a heat map of growth regulator candidate genes enriched to the circadian rhythm-plant pathway.

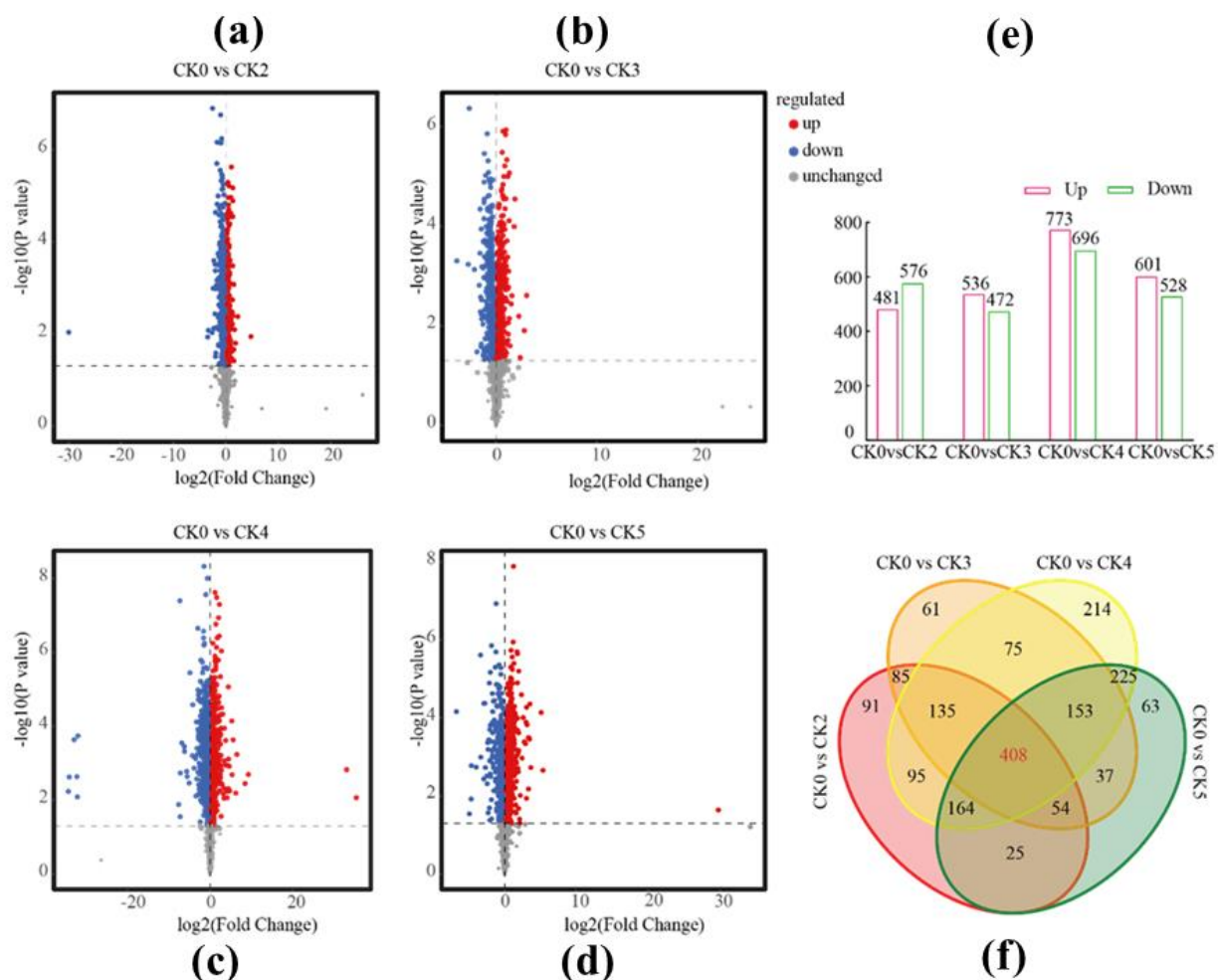


(a)



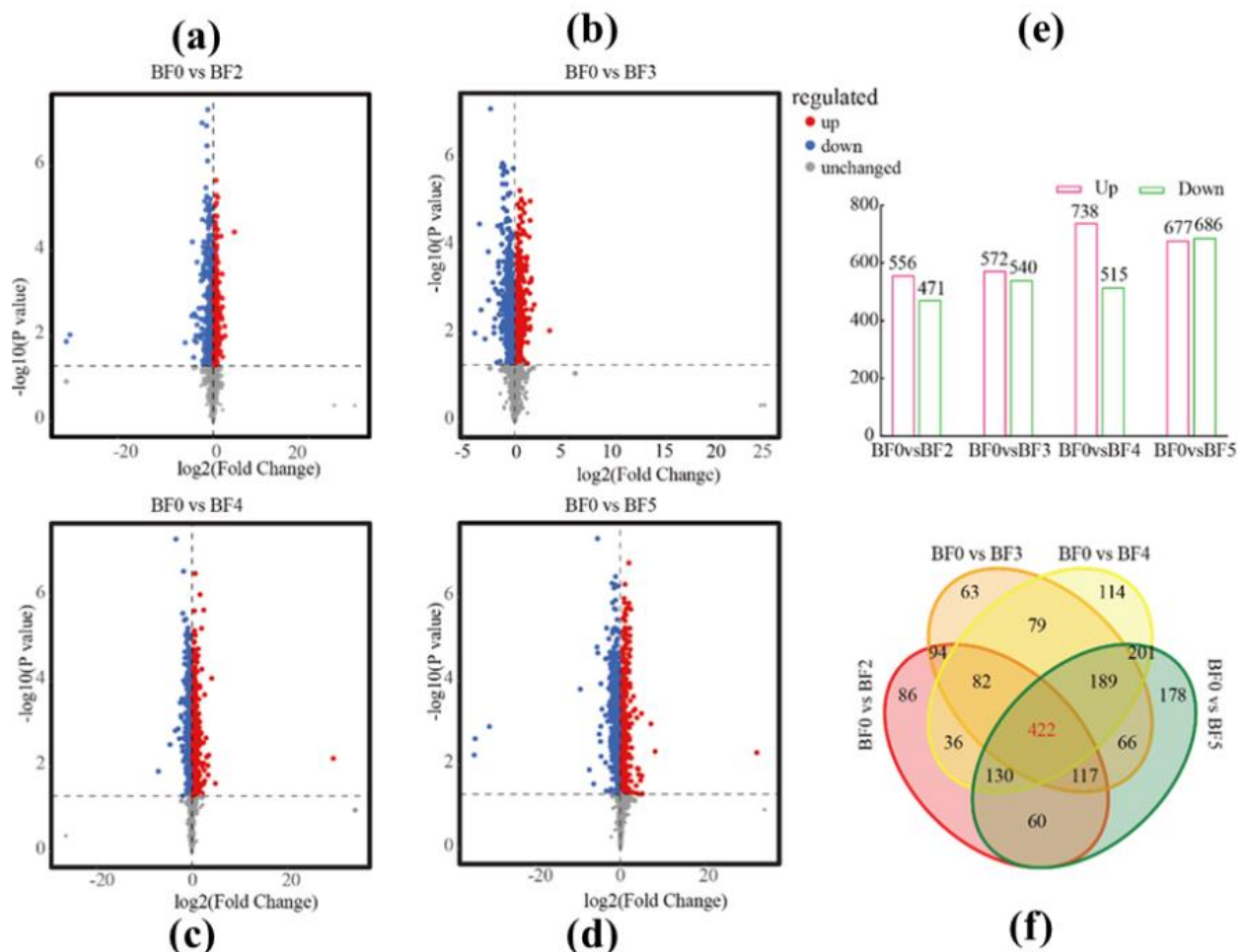
(b)

**Supplementary Figure S7:** Top 20 classification chart of metabolites in flower spikes under low-temperature conditions. Here, (a) indicates CK groups, and (b) indicates BF groups of the top 20 classification chart of metabolites.

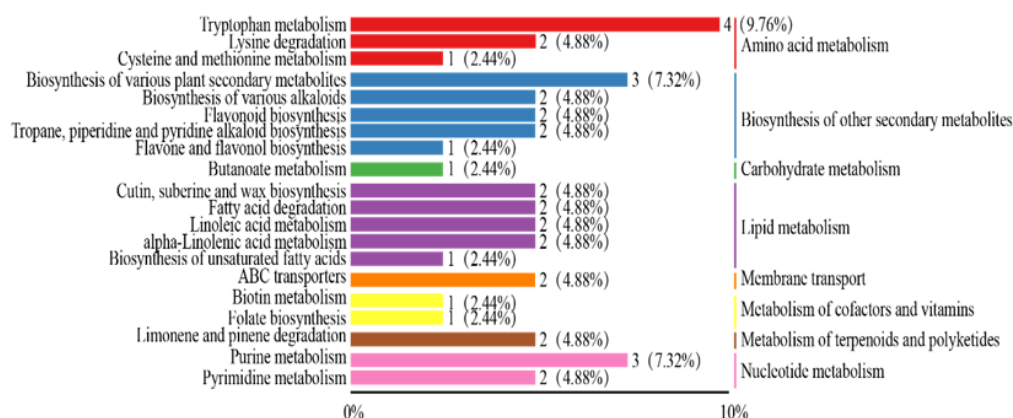


**Supplementary Figure S8:** Differential Metabolite content distribution of flower spikes under low temperature conditions. Here, (a–d) indicate differential expression volcano plots comparison among CK0 (0d) vs CK2 (2d), CK0 (0d) vs CK3 (3d), CK0 (0d) vs CK4 (4d), and CK0 (0d) vs CK5 (5d), respectively. Where (e) indicate, the histogram, and (f) indicates the Venn diagram of the number of DEMs in the CK groups.

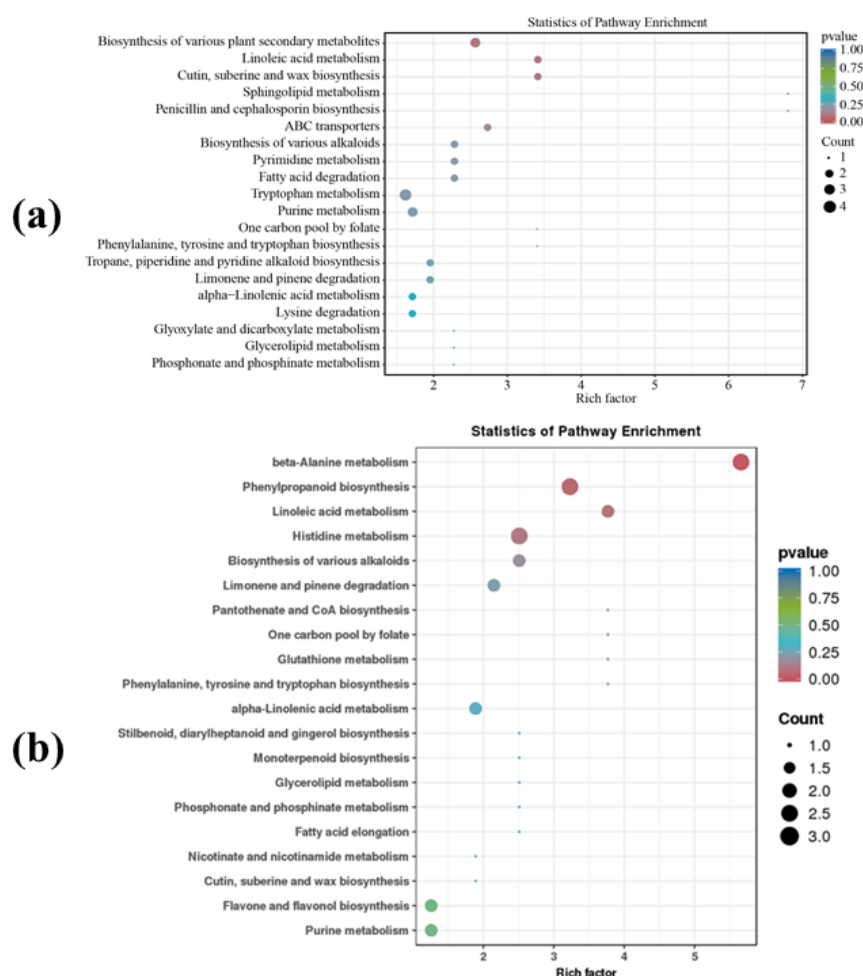




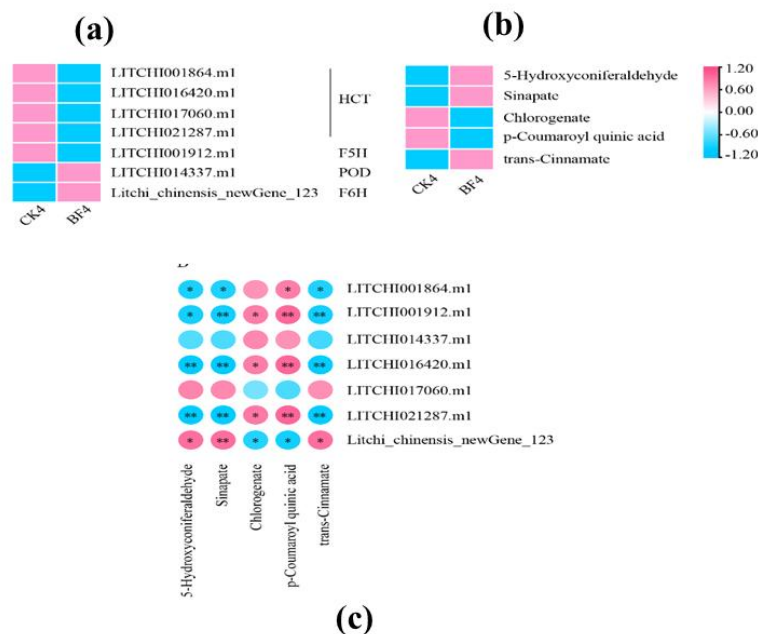
**Supplementary Figure S9:** Differential metabolites of flower spikes under low temperature conditions treated with plant growth regulators. Here, **(a–d)** indicate differential volcano plots comparison among BF0 (0d) vs BF2 (2d), BF0 (0d) vs BF3 (3d), BF0 (0d) vs BF4 (4d), and BF0 (0d) vs BF5 (5d), respectively. Where **(e)** indicates the histogram, and **(f)** indicates the Venn diagram of the number of DEMs in the BF groups.



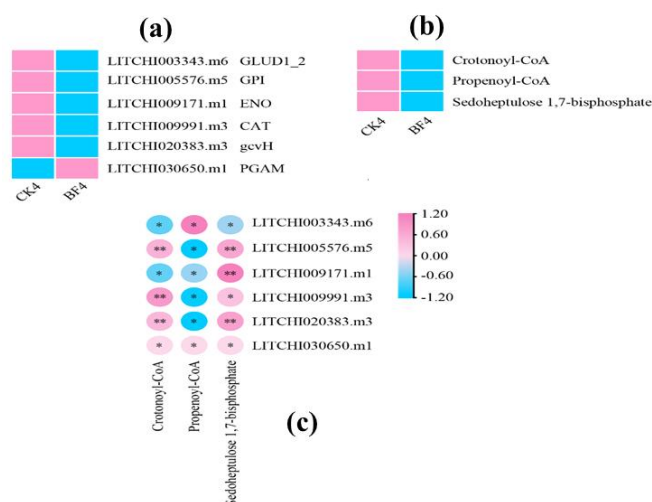
**Supplementary Figure S10:** Metabolite content distribution of flower spikes under low temperature conditions.



**Supplementary Figure S11:** KEGG bubble plots of metabolites in flower spikes under low temperature conditions. Here, (a) indicates CK groups, and (b) indicates BF groups.

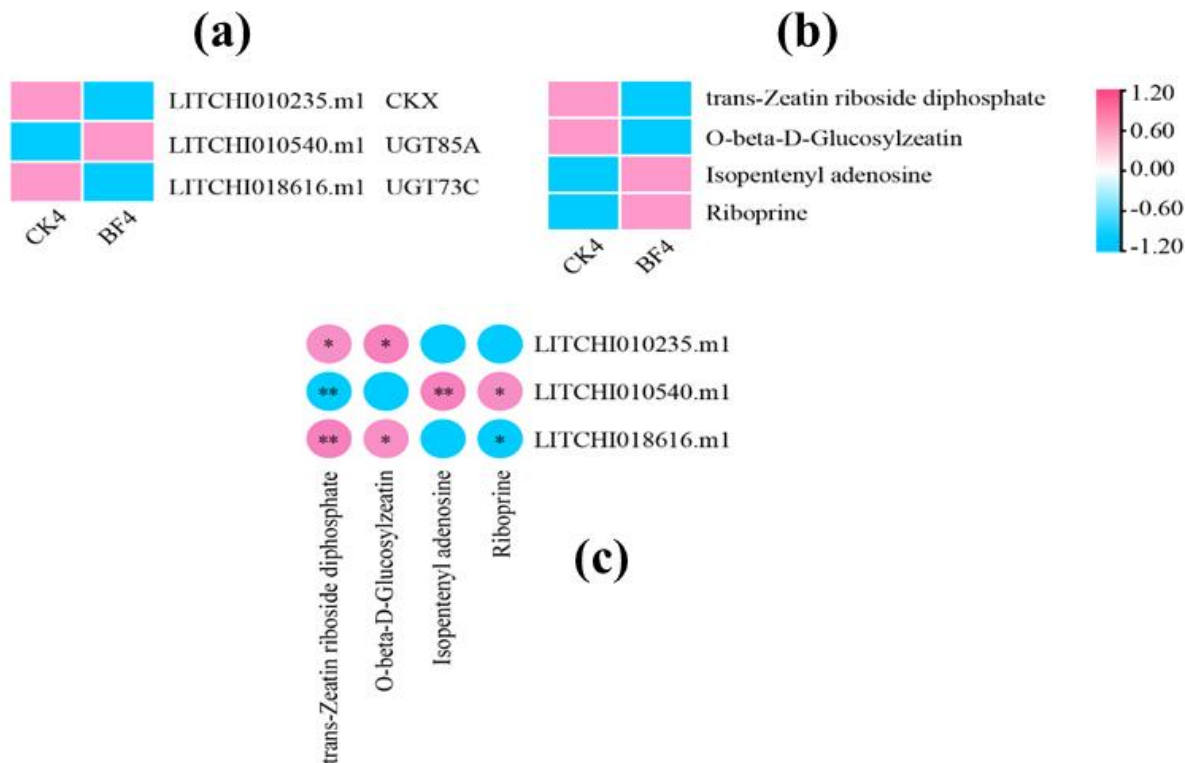


**Supplementary Figure 12:** Correlation analysis of thermal map of DEGs and DAMs for phenylpropyl biosynthesis pathway. Here, (a) Thermogram of phenyl propyl biological pathway DEGs, (b) Thermal map of the phenyl propyl biological pathway DAMs, (c) The correlation heat map of phenyl propyl biosynthesis path DEGs and DAMs shows that no star indicators no significant correlation ( $p > 0.05$ ), one-star indicators significant correlation ( $p < 0.05$ ), and two-star circles indicate very significant correlation ( $p < 0.01$ ).



**Supplementary Figure S13:** Correlation analysis of the thermal map of DEGs and DAMs for Carbon metabolism pathway. Here, (a) a Thermogram of the Carbon metabolism

pathway DEGs, (b) a thermal map of the Carbon metabolism pathway DAMs, (c) The correlation heat map of the Carbon metabolism pathway DEGs and DAMs.



**Supplementary Figure S14:** Correlation analysis of thermal map of DEGs and DAMs for Zeatin biosynthesis pathway. Here, (a,b) indicate the heat map of zeatin biosynthetic pathway DEGs and DAMs, respectively, (c) the Correlation heat map of zeatin biosynthetic pathway DEGs and DAMs.

## Supplementary Tables

**Supplementary Table S1 :** Fruit Survival Percentage (%).

Fruit Survival Percentage (%)			
(Mean ± SD)			
Treatment	1.5 Month	2.5 Month	3.0 Month
CK	15.42 ± 6.09	12.42 ± 6.93	8.58 ± 8.44
BF	51.92 ± 5.09	46.92 ± 5.23	30.08 ± 6.50
LL	31.25 ± 2.19	26.25 ± 3.59	23.33 ± 3.7

**Supplementary Table S2. SOD, POD, CAT activity, and MDA content.**

SOD Activity nmol <sup>-1</sup> (mg protein) <sup>-1</sup> (Mean ± SD)							
Treatment	0 Day	2day	3day	4 day	5 day	8 day	14 day
CK	2.88 ± 0.03 <sup>Ad</sup>	5.35 ± 0.22 <sup>Aa</sup>	4.18 ± 0.16 <sup>Ab</sup>	2.03 ± 0.18 <sup>Be</sup>	1.47 ± 0.09 <sup>ABf</sup>	2.41 ± 0.06 <sup>Ae</sup>	3.39 ± 0.11 <sup>Ac</sup>
BF	2.88 ± 0.03 <sup>Ac</sup>	1.38 ± 0.09 <sup>Ce</sup>	4.32 ± 0.14 <sup>Aa</sup>	4.41 ± 0.22 <sup>Aa</sup>	1.82 ± 0.13 <sup>Ad</sup>	2.12 ± 0.11 <sup>ABd</sup>	3.63 ± 0.04 <sup>Ab</sup>
LL	2.88 ± 0.03 <sup>Aa</sup>	2.90 ± 0.03 <sup>Ba</sup>	1.78±0.05 <sup>Bc</sup>	2.19 ± 0.11 <sup>Bb</sup>	1.42 ± 0.05 <sup>Bd</sup>	1.96 ± 0.08 <sup>Bc</sup>	2.28 ± 0.015 <sup>Bb</sup>
POD activity nmol <sup>-1</sup> (mg protein) <sup>-1</sup> (Mean ± SD)							
CK	3.52 ± 0.026 <sup>Acd</sup>	3.77 ± 0.006 <sup>Abcd</sup>	4.82 ± 0.043 <sup>Aab</sup>	4.36 ± 0.032 <sup>Babc</sup>	3.18 ± 0.036 <sup>Bd</sup>	6.08 ± 0.049 <sup>Aa</sup>	4.26 ± 0.040 <sup>Aabcd</sup>
BF	3.52 ± 0.026 <sup>Ad</sup>	3.45 ± 0.008 <sup>Bd</sup>	3.21 ± 0.037 <sup>Be</sup>	4.90 ± 0.046 <sup>Aa</sup>	4.32 ± 0.038 <sup>Ab</sup>	4.01 ± 0.038 <sup>Ac</sup>	3.18 ± 0.026 <sup>Ce</sup>
LL	3.52 ± 0.026 <sup>Ad</sup>	3.33 ± 0.02 <sup>Ce</sup>	2.55 ± 0.024 <sup>Cg</sup>	3.09 ± 0.032 <sup>Cf</sup>	4.24 ± 0.029 <sup>Ab</sup>	4.80 ± 0.090 <sup>Aa</sup>	3.73 ± 0.012 <sup>Bc</sup>
CAT activity nmol <sup>-1</sup> (mg protein) <sup>-1</sup> (Mean ± SD)							
CK	1.97 ± 0.86 <sup>Aab</sup>	1.61 ± 0.15 <sup>Ab</sup>	2.13 ± 0.12 <sup>Ba</sup>	1.10 ± 0.18 <sup>Ac</sup>	0.33 ± 0.08 <sup>Bd</sup>	0.61 ± 0.13 <sup>ABd</sup>	0.53 ± 0.07 <sup>Bd</sup>
BF	1.97 ± 0.867 <sup>Ac</sup>	0.35 ± 0.06 <sup>Be</sup>	2.80 ± 0.17 <sup>Ab</sup>	3.34 ± 0.20 <sup>Ba</sup>	1.21 ± 0.15 <sup>Ad</sup>	0.41 ± 0.35 <sup>Be</sup>	1.40 ± 0.08 <sup>Ad</sup>
LL	1.97 ± 0.867 <sup>Aa</sup>	0.56 ± 0.06 <sup>Bd</sup>	1.08 ± 0.04 <sup>Cc</sup>	1.01 ± 0.07 <sup>Bc</sup>	0.52 ± 0.10 <sup>Bd</sup>	0.82 ± 0.12 <sup>Acd</sup>	1.47 ± 0.13 <sup>Ab</sup>
MDA activity (nmol.g <sup>-1</sup> FW) (Mean ± SD)							
CK	0.70 ± 0.05 <sup>Ab</sup>	0.83 ± 0.03 <sup>ABa</sup>	0.88 ± 0.00 <sup>Aa</sup>	0.89 ± 0.03 <sup>Aa</sup>	0.67 ± 0.01 <sup>Ab</sup>	0.55 ± 0.01 <sup>Bc</sup>	0.68 ± 0.03 <sup>Bb</sup>
BF	0.70 ± 0.05 <sup>Ac</sup>	0.85 ± 0.05 <sup>Aab</sup>	0.91 ± 0.01 <sup>Aa</sup>	0.74 ± 0.04 <sup>Bbc</sup>	0.72 ± 0.02 <sup>Ac</sup>	0.75 ± 0.02 <sup>Abc</sup>	0.71 ± 0.02A <sup>ABc</sup>
LL	0.70 ± 0.05 <sup>Abc</sup>	0.68 ± 0.05 <sup>Bc</sup>	0.90 ± 0.02 <sup>Aa</sup>	0.81 ± 0.02 <sup>ABab</sup>	0.67 ± 0.06 <sup>Ac</sup>	0.72 ± 0.01 <sup>Abc</sup>	0.77 ± 0.02 <sup>Abc</sup>

**Supplementary Table S3: Soluble Protein and Proline content.**

Soluble Protein (mg/g) (Mean ± SD)							
Treatment	0 Day	2day	3day	4 day	5 day	8 day	14 day
CK	14.34 ± 0.23 <sup>Ac</sup>	16.34 ± 0.32 <sup>Ab</sup>	16.28 ± 0.11 <sup>Bb</sup>	12.34 ± 0.28 <sup>Bd</sup>	11.23 ± 0.10 <sup>Be</sup>	6.95 ± 0.16 <sup>Cf</sup>	17.68 ± 0.24 <sup>Aa</sup>
BF	14.34 ± 0.23 <sup>Ad</sup>	9.79 ± 0.02 <sup>Bf</sup>	17.01 ± 0.13 <sup>Aa</sup>	16.33 ± 0.21 <sup>Ab</sup>	17.44 ± 0.26 <sup>Aa</sup>	11.17 ± 0.20 <sup>Be</sup>	15.54 ± 0.11 <sup>Bc</sup>
LL	14.34 ± 0.23 <sup>Ac</sup>	9.25 ± 0.04 <sup>Bf</sup>	9.99 ± 0.06 <sup>Ce</sup>	8.42 ± 0.04 <sup>Cg</sup>	11.71 ± 0.26 <sup>Bd</sup>	16.67 ± 0.27 <sup>Aa</sup>	15.13 ± 0.17 <sup>Bb</sup>
Proline content (ug/g) (Mean ± SD)							
CK	116.82 ± 9.88 <sup>Ad</sup>	197.57 ± 17.36 <sup>Ac</sup>	131.28 ± 8.85 <sup>Ad</sup>	221.33 ± 3.62 <sup>Cc</sup>	306.04 ± 10.35 <sup>Ab</sup>	343.75 ± 13.08 <sup>Aa</sup>	194.82 ± 7.63 <sup>Ac</sup>
BF	116.82 ± 9.88 <sup>Ad</sup>	88.76 ± 5.47 <sup>Bd</sup>	119.06 ± 11.94 <sup>Ad</sup>	422.78 ± 11.62 <sup>Aa</sup>	284.18 ± 35.47 <sup>Ab</sup>	185.69 ± 19.20 <sup>Bc</sup>	253.53 ± 30.23 <sup>Ab</sup>
LL	116.82 ± 9.88 <sup>Acd</sup>	96.16 ± 8.69 <sup>Bd</sup>	138.52 ± 8.66 <sup>Ac</sup>	321.88 ± 21.9 <sup>Ba</sup>	267.3 ± 12.53 <sup>Ab</sup>	98.23 ± 3.13 <sup>Cd</sup>	259.56 ± 10.13 <sup>Ab</sup>

**Supplementary Table S4: Fructose, glucose, sucrose, and total sugar content.**

Fructose content (mg/g) (Mean ± SD)							
Treatment	0 Day	2day	3day	4 day	5 day	8 day	14 day
CK	1.15 ± 0.004 <sup>Aab</sup>	0.70 ± 0.003 <sup>Ae</sup>	0.77 ± 0.009 <sup>Ac</sup>	1.14 ± 0.009 <sup>Bb</sup>	1.17 ± 0.004 <sup>Ca</sup>	0.67 ± 0.007 <sup>Bf</sup>	0.74 ± 0.009 <sup>Bd</sup>
BF	1.15 ± 0.004 <sup>Ac</sup>	0.41 ± 0.009 <sup>Cg</sup>	0.71 ± 0.01 <sup>Bf</sup>	1.28 ± 0.005 <sup>Aa</sup>	1.25 ± 0.002 <sup>Bb</sup>	1.05 ± 0.025 <sup>Ad</sup>	0.84 ± 0.013 <sup>Ae</sup>
LL	1.15 ± 0.004 <sup>Ab</sup>	0.58 ± 0.002 <sup>Bg</sup>	0.70 ± 0.01 <sup>Bf</sup>	0.95 ± 0.022 <sup>Cd</sup>	1.34 ± 0.001 <sup>Aa</sup>	1.08 ± 0.003 <sup>Ac</sup>	0.88 ± 0.023 <sup>Ae</sup>
Glucose content (mg/g) (Mean ± SD)							
CK	8.35 ± 0.025 <sup>Ac</sup>	7.58 ± 0.022 <sup>Ae</sup>	8.45 ± 0.023 <sup>Ab</sup>	8.26 ± 0.012 <sup>Bd</sup>	10.22 ± 0.024 <sup>Aa</sup>	5.38 ± 0.046 <sup>Cg</sup>	6.35 ± 0.015 <sup>Cf</sup>
BF	8.35 ± 0.025 <sup>Ab</sup>	4.14 ± 0.067 <sup>Cf</sup>	6.81 ± 0.014 <sup>Cd</sup>	10.28 ± 0.017 <sup>Aa</sup>	8.33 ± 0.008 <sup>Bb</sup>	5.92 ± 0.080 <sup>Be</sup>	7.27 ± 0.033 <sup>Bc</sup>
LL	8.35 ± 0.025 <sup>Ab</sup>	7.27 ± 0.005 <sup>Bd</sup>	7.81 ± 0.114 <sup>Bc</sup>	7.8 ± 0.047 <sup>Cc</sup>	10.28 ± 0.007 <sup>Aa</sup>	6.94 ± 0.009 <sup>Ae</sup>	8.38 ± 0.076 <sup>Ab</sup>
Sucrose content (mg/g) (Mean ± SD)							
CK	2.48 ± 0.024 <sup>Af</sup>	4.93 ± 0.014 <sup>Ad</sup>	7.00 ± 0.011 <sup>Ac</sup>	7.75 ± 0.074 <sup>Bb</sup>	8.36 ± 0.012 <sup>Aa</sup>	4.27 ± 0.037 <sup>Ce</sup>	4.18 ± 0.007 <sup>Ae</sup>
BF	2.48 ± 0.024 <sup>Af</sup>	2.77 ± 0.026 <sup>Cf</sup>	6.49 ± 0.260 <sup>Ac</sup>	9.45 ± 0.151 <sup>Aa</sup>	8.69 ± 0.166 <sup>Ab</sup>	5.68 ± 0.260 <sup>Bd</sup>	4.35 ± 0.008 <sup>Ae</sup>
LL	2.48 ± 0.024 <sup>Ae</sup>	4.05 ± 0.015 <sup>Bd</sup>	6.61 ± 0.058 <sup>Ac</sup>	7.56 ± 0.060 <sup>Bb</sup>	8.67 ± 0.135 <sup>Aa</sup>	6.47 ± 0.004 <sup>Ac</sup>	4.20 ± 0.150 <sup>Ad</sup>
Total Sugar content (mg/g) (Mean ± SD)							
CK	11.99 ± 0.04 <sup>Ag</sup>	13.21 ± 0.02 <sup>Ad</sup>	16.23 ± 0.01 <sup>Ac</sup>	17.16 ± 0.09 <sup>Bb</sup>	19.76 ± 0.04 <sup>Ba</sup>	10.32 ± 0.09 <sup>Cf</sup>	11.26 ± 0.02 <sup>Ce</sup>
BF	11.99 ± 0.04 <sup>Af</sup>	7.33 ± 0.05 <sup>Ce</sup>	14.01 ± 0.26 <sup>Cc</sup>	21.02 ± 0.13 <sup>Aa</sup>	18.27 ± 0.17 <sup>Cb</sup>	12.64 ± 0.30 <sup>Bd</sup>	12.46 ± 0.05 <sup>Bd</sup>
LL	11.99 ± 0.04 <sup>Ag</sup>	11.90 ± 0.01 <sup>Bf</sup>	15.12 ± 0.09 <sup>Bc</sup>	16.32 ± 0.11 <sup>Cb</sup>	20.29 ± 0.13 <sup>Aa</sup>	14.48 ± 0.01 <sup>Ad</sup>	13.46 ± 0.20 <sup>Ae</sup>

**Supplementary Table S5: Sucrose Phosphate Synthase activity and Sucrose Synthase activity.**

Sucrose Phosphate Synthase Activity (umol/s/g FW) (Mean ± SD)							
Treatment	0 Day	2day	3day	4 day	5 day	8 day	14 day
CK	29.88 ± 1.78 <sup>Aa</sup>	14.15 ± 0.34 <sup>Bb</sup>	4.69 ± 0.14 <sup>Cd</sup>	9.55 ± 0.34 <sup>Bc</sup>	6.35 ± 1.51 <sup>Bcd</sup>	27.84 ± 2.57 <sup>Aa</sup>	7.93 ± 0.17 <sup>Ccd</sup>
BF	29.88 ± 1.78 <sup>Ab</sup>	35.34 ± 2.14 <sup>Aa</sup>	8.98 ± 0.07 <sup>Bde</sup>	7.27 ± 0.09 <sup>Ce</sup>	23.25 ± 2.71 <sup>Ac</sup>	5.17 ± 0.77 <sup>Be</sup>	12.81 ± 1.19 <sup>Bd</sup>
LL	29.88 ± 1.78 <sup>Aa</sup>	1.83 ± 0.10 <sup>Ce</sup>	11.08 ± 0.43 <sup>Abc</sup>	13.56 ± 0.68 <sup>Ab</sup>	7.79 ± 0.99 <sup>Bd</sup>	9.84 ± 0.40 <sup>Bcd</sup>	31.62 ± 0.62 <sup>Aa</sup>
Sucrose Synthase Activity (umol/s/g FW) (Mean ± SD)							
CK	25.89 ± 1.65 <sup>Aa</sup>	15.76 ± 0.88 <sup>Bc</sup>	5.21 ± 0.40 <sup>Be</sup>	10.48 ± 0.44 <sup>Bd</sup>	8.31 ± 1.18 <sup>Bde</sup>	22.73 ± 1.32 <sup>Ab</sup>	5.50 ± 0.56 <sup>Ce</sup>
BF	25.89 ± 1.65 <sup>Ac</sup>	51.25 ± 2.62 <sup>Aa</sup>	8.06 ± 0.48 <sup>Ae</sup>	7.63 ± 0.41 <sup>Be</sup>	39.95 ± 2.38 <sup>Ab</sup>	7.18 ± 1.08 <sup>Be</sup>	13.90 ± 0.79 <sup>Bd</sup>
LL	25.89 ± 1.65 <sup>Ab</sup>	2.86 ± 0.35 <sup>Cf</sup>	9.51 ± 0.38 <sup>Ade</sup>	15.76 ± 2.12 <sup>Ac</sup>	10.59 ± 1.33 <sup>Bd</sup>	5.14 ± 1.33 <sup>Bef</sup>	37.61 ± 2.85 <sup>Aa</sup>

**Supplementary Table S6: P5CS, P5CR, ProDH, and δ- OAT activity.**

P5CS activity (μmol/h/g) (Mean)							
Treatment	0 Day	2day	3day	4 day	5 day	8 day	14 day
CK	1.0637	1.0839	1.0358	1.1385	1.3283	1.1215	1.1419
BF	1.0637	1.7561	1.8194	2.2883	2.129	2.0903	1.9031
LL	1.0637	2.4146	2.8531	2.2635	2.2251	2.2479	1.9812
P5CR activity (nmol/min/g) (Mean)							
CK	137.72	136.75	106.46	131.09	106.63	129.45	114.49
BF	137.72	92.724	98.206	118.93	159.91	150.55	122.81
LL	137.72	107.69	128.07	138	115.2	129.7	134.7

ProDH activity (U/g)							
(Mean)							
CK	467.05	464.51	422.07	552.59	366.45	419.81	406.6
BF	467.05	467.56	584.2	530.8	435.53	508.46	449.27
LL	467.05	597.96	488.99	497.09	390.04	566.71	567.23
δ- OAT activity (nmol/min/g)							
(Mean)							
CK	24.067	22.764	27.625	29.636	23.465	18.895	18.182
BF	24.067	36.117	36.473	38.674	39.834	41.305	40.952
LL	24.067	40.785	42.491	44.536	31.239	33.846	40.073