

Soil organic carbon mineralization and its temperature sensitivity under different carbon contents in the Mollisols of Northeast China

Supplementary Table S1. Changes in cumulative CO₂ production with varied SOC contents when incubated at 5 °C.

| Incubation time | SOC10 | | SOC19 | | SOC29 | | SOC34 | | SOC63 | |
|-----------------|--------|----|--------|-----|--------|------|--------|----|--------|----|
| 1 | 34.32 | DI | 54.09 | Ck | 76.94 | Bl | 87.52 | Bl | 120.48 | Ak |
| 3 | 101.30 | Ek | 116.88 | Dj | 146.16 | Ck | 158.73 | Bk | 202.55 | Aj |
| 5 | 150.23 | Dj | 168.26 | Ci | 198.47 | Bj | 211.08 | Bj | 250.97 | Ai |
| 7 | 213.18 | Di | 226.88 | Ch | 255.76 | Bi | 260.04 | Bi | 305.55 | Ah |
| 14 | 272.10 | Dh | 314.25 | Cg | 338.50 | Bh | 346.37 | Bh | 370.33 | Ag |
| 21 | 344.36 | Dg | 367.53 | Cf | 393.25 | Bg | 407.01 | Bg | 444.25 | Af |
| 28 | 397.78 | Df | 421.20 | Ce | 439.72 | BCf | 448.62 | Bf | 502.92 | Ae |
| 35 | 444.63 | Ce | 463.87 | Cd | 494.93 | Be | 507.34 | Be | 554.44 | Ad |
| 42 | 487.66 | Cd | 508.70 | BCc | 526.87 | Bd | 533.66 | Bd | 582.80 | Ac |
| 49 | 518.10 | Dc | 537.41 | Cb | 557.29 | Bc | 565.34 | Bc | 613.74 | Ab |
| 56 | 539.76 | Cb | 554.97 | Cb | 578.73 | Bb | 586.72 | Bb | 626.07 | Ab |
| 63 | 553.90 | Da | 574.25 | CDa | 590.85 | BCab | 609.54 | Ba | 648.71 | Aa |
| 73 | 567.10 | Da | 587.11 | Ca | 599.33 | Ca | 624.05 | Ba | 659.32 | Aa |

Note: Values correspond to averages of n = 3 samples per treatment. Different uppercase letters indicate significant differences between SOC contents at the same incubated time, and different lower letters indicate significant differences between incubated time at the same SOC contents ($p < 0.05$).

Supplementary Table S2. Variations of cumulative CO₂ production among different SOC contents when incubated at 15 °C.

| Incubation time | SOC10 | | SOC19 | | SOC29 | | SOC34 | | SOC63 | |
|-----------------|--------|-----|--------|------|--------|-----|--------|-----|--------|----|
| 1 | 63.01 | DI | 89.03 | CI | 111.97 | BI | 119.41 | BI | 143.33 | AK |
| 3 | 130.48 | Dk | 146.60 | Dk | 170.07 | Ck | 189.63 | Bk | 228.08 | Aj |
| 5 | 185.42 | Dj | 206.61 | CDj | 230.81 | BCj | 243.47 | Bj | 281.01 | Ai |
| 7 | 242.81 | Ci | 256.71 | Ci | 276.93 | Bi | 278.68 | Bi | 328.60 | Ah |
| 14 | 313.79 | Dh | 329.73 | Ch | 349.63 | Bh | 357.55 | Bh | 409.09 | Ag |
| 21 | 369.90 | Cg | 383.47 | Cg | 416.81 | Bg | 420.57 | Bg | 466.99 | Af |
| 28 | 427.39 | Cf | 440.23 | Cf | 459.32 | Bf | 470.59 | Bf | 529.99 | Ae |
| 35 | 471.76 | De | 497.66 | Ce | 521.18 | Be | 529.71 | Be | 587.37 | Ad |
| 42 | 520.18 | Dd | 538.65 | Cd | 560.27 | Bd | 567.59 | Bd | 617.21 | Ac |
| 49 | 547.85 | Cc | 564.44 | Cc | 588.55 | Bc | 599.29 | Bc | 657.80 | Ab |
| 56 | 573.21 | Db | 592.97 | Cb | 616.04 | Bb | 621.01 | Bb | 677.57 | Ab |
| 63 | 586.65 | Dab | 609.41 | CDab | 622.30 | BCb | 641.60 | Bab | 701.00 | Aa |
| 73 | 599.27 | Da | 624.27 | Ca | 642.79 | BCa | 657.97 | Ba | 718.82 | Aa |

Note: Values correspond to averages of n = 3 samples per treatment. Different uppercase letters indicate significant differences between SOC contents at the same incubated time, and different lower letters indicate significant differences between incubated time at the same SOC contents ($p < 0.05$). The same as below.

Supplementary Table S3. Alterations in cumulative CO₂ production between SOC contents when incubated at 25 °C.

| Incubation time | SOC10 | | SOC19 | | SOC29 | | SOC34 | | SOC63 | |
|-----------------|--------|----|--------|-----|--------|-----|--------|----|--------|----|
| 1 | 91.20 | DI | 108.81 | CI | 131.05 | BCm | 144.64 | BI | 174.23 | Am |
| 3 | 172.15 | Ck | 191.40 | BCK | 208.19 | BI | 212.89 | Bk | 241.20 | Al |
| 5 | 204.03 | Dj | 231.21 | Cj | 259.40 | BCK | 268.09 | Bj | 305.50 | AK |
| 7 | 264.66 | Ci | 282.14 | Ci | 312.01 | Bj | 329.54 | Bi | 373.48 | Aj |
| 14 | 351.79 | Dh | 370.62 | CDh | 394.66 | BCi | 406.06 | Bh | 453.52 | Ai |
| 21 | 403.76 | Dg | 417.62 | CDg | 437.87 | BCh | 454.84 | Bg | 510.97 | Ah |
| 28 | 457.70 | Cf | 464.00 | Cf | 509.74 | Bg | 523.70 | Bf | 567.86 | Ag |
| 35 | 502.46 | De | 521.12 | Ce | 546.15 | Bf | 560.96 | Be | 642.18 | Af |
| 42 | 531.52 | Ed | 551.79 | Dd | 583.61 | Ce | 605.60 | Bd | 681.88 | Ae |
| 49 | 572.03 | Ec | 606.12 | Dc | 626.40 | Cd | 649.66 | Bc | 707.24 | Ad |
| 56 | 627.15 | Db | 643.04 | CDb | 656.59 | BCc | 664.77 | Bc | 728.22 | Ac |
| 63 | 643.08 | Db | 665.00 | CDa | 682.41 | BCb | 705.48 | Bb | 750.19 | Ab |
| 73 | 664.74 | Ca | 682.59 | Ca | 713.03 | Ba | 733.55 | Ba | 785.44 | Aa |

Supplementary Table S4. Changes in cumulative CO₂ production with different SOC contents when incubated at 35 °C.

| Incubation time | SOC10 | | SOC19 | | SOC29 | | SOC34 | | SOC63 | |
|-----------------|--------|-----|--------|-----|--------|-----|--------|----|---------|----|
| 1 | 123.70 | El | 155.50 | DI | 184.48 | CI | 208.34 | BI | 245.70 | Am |
| 3 | 213.93 | Dk | 239.65 | Ck | 269.45 | BCk | 283.74 | Bk | 332.87 | Al |
| 5 | 278.35 | DEj | 286.40 | Dj | 316.37 | Cj | 338.93 | Bj | 389.83 | Ak |
| 7 | 336.49 | Di | 364.37 | Ci | 384.15 | BCi | 392.13 | Bi | 436.29 | Aj |
| 14 | 382.10 | Dh | 405.83 | CDh | 426.36 | BCh | 435.14 | Bh | 516.22 | Ai |
| 21 | 436.72 | Eg | 465.39 | Dg | 489.38 | Cg | 514.52 | Bg | 603.17 | Ah |
| 28 | 511.17 | Df | 531.94 | Cf | 561.60 | Bf | 576.75 | Bf | 696.66 | Ag |
| 35 | 548.43 | Ee | 601.00 | De | 624.51 | Ce | 646.38 | Be | 778.82 | Af |
| 42 | 610.05 | Ed | 645.78 | Dd | 689.51 | Cd | 712.67 | Bd | 837.41 | Ae |
| 49 | 651.78 | Cc | 672.64 | Cc | 738.78 | Bc | 754.92 | Bc | 893.69 | Ad |
| 56 | 687.23 | Eb | 711.33 | Db | 765.75 | Cb | 784.64 | Bb | 937.01 | Ac |
| 63 | 705.46 | Ea | 728.87 | Da | 779.31 | Cb | 799.26 | Bb | 963.48 | Ab |
| 73 | 714.95 | Ea | 742.28 | Da | 807.80 | Ca | 821.50 | Ba | 1003.91 | Aa |

Note: Values correspond to averages of $n = 3$ samples per treatment. Different uppercase letters indicate significant differences between SOC contents at the same incubated time, and different lower letters indicate significant differences between incubated time at the same SOC contents ($p < 0.05$).

Supplementary Table S5. Alterations of cumulative CO₂ production under SOC10 among incubation temperatures.

| Incubation temperature | 5 °C | | 15 °C | | 25 °C | | 35 °C | |
|------------------------|--------|---|--------|---|--------|---|--------|---|
| 1 | 34.32 | D | 63.01 | C | 91.20 | B | 123.70 | A |
| 3 | 101.30 | D | 130.48 | C | 172.15 | B | 213.93 | A |
| 5 | 150.23 | D | 185.42 | C | 204.03 | B | 278.35 | A |
| 7 | 213.18 | D | 242.81 | C | 264.66 | B | 336.49 | A |
| 14 | 272.10 | D | 313.79 | C | 351.79 | B | 382.10 | A |
| 21 | 344.36 | D | 369.90 | C | 403.76 | B | 436.72 | A |
| 28 | 397.78 | D | 427.39 | C | 457.70 | B | 511.17 | A |
| 35 | 444.63 | D | 471.76 | C | 502.46 | B | 548.43 | A |
| 42 | 487.66 | C | 520.18 | B | 531.52 | B | 610.05 | A |
| 49 | 518.10 | D | 547.85 | C | 572.03 | B | 651.78 | A |
| 56 | 539.76 | D | 573.21 | C | 627.15 | B | 687.23 | A |
| 63 | 553.90 | D | 586.65 | C | 643.08 | B | 705.46 | A |
| 73 | 567.10 | D | 599.27 | C | 664.74 | B | 714.95 | A |

Note: Values correspond to averages of $n = 3$ samples per treatment. Different uppercase letters indicate significant differences between incubation temperatures at the same SOC contents ($p < 0.05$).

Supplementary Table S6. Changes in cumulative CO₂ production in the SOC19 with different incubation temperatures.

| Incubation temperature | 5 °C | | 15 °C | | 25 °C | | 35 °C | |
|------------------------|--------|---|--------|---|--------|---|--------|---|
| 1 | 54.09 | D | 89.03 | C | 108.81 | B | 155.50 | A |
| 3 | 116.88 | D | 146.60 | C | 191.40 | B | 239.65 | A |
| 5 | 168.26 | C | 206.61 | B | 231.21 | B | 286.40 | A |
| 7 | 226.88 | D | 256.71 | C | 282.14 | B | 364.37 | A |
| 14 | 314.25 | C | 329.73 | C | 370.62 | B | 405.83 | A |
| 21 | 367.53 | C | 383.47 | C | 417.62 | B | 465.39 | A |
| 28 | 421.20 | C | 440.23 | C | 464.00 | B | 531.94 | A |
| 35 | 463.87 | D | 497.66 | C | 521.12 | B | 601.00 | A |
| 42 | 508.70 | C | 538.65 | B | 551.79 | B | 645.78 | A |
| 49 | 537.41 | D | 564.44 | C | 606.12 | B | 672.64 | A |
| 56 | 554.97 | D | 592.97 | C | 643.04 | B | 711.33 | A |
| 63 | 574.25 | D | 609.41 | C | 665.00 | B | 728.87 | A |
| 73 | 587.11 | D | 624.27 | C | 682.59 | B | 742.28 | A |

Note: Values correspond to averages of n = 3 samples per treatment. Different uppercase letters indicate significant differences between incubation temperatures at the same SOC contents ($p < 0.05$).

Supplementary Table S7. Variations of cumulative CO₂ production under SOC29 between incubation temperatures.

| Incubation temperature | 5 °C | | 15 °C | | 25 °C | | 35 °C | |
|------------------------|--------|---|--------|---|--------|---|--------|---|
| 1 | 76.94 | D | 111.97 | C | 131.05 | B | 184.48 | A |
| 3 | 146.16 | D | 170.07 | C | 208.19 | B | 269.45 | A |
| 5 | 198.47 | D | 230.81 | C | 259.40 | B | 316.37 | A |
| 7 | 255.76 | C | 276.93 | C | 312.01 | B | 384.15 | A |
| 14 | 338.50 | C | 349.63 | C | 394.66 | B | 426.36 | A |
| 21 | 393.25 | D | 416.81 | C | 437.87 | B | 489.38 | A |
| 28 | 439.72 | C | 459.32 | C | 509.74 | B | 561.60 | A |
| 35 | 494.93 | D | 521.18 | C | 546.15 | B | 624.51 | A |
| 42 | 526.87 | D | 560.27 | C | 583.61 | B | 689.51 | A |
| 49 | 557.29 | D | 588.55 | C | 626.40 | B | 738.78 | A |
| 56 | 578.73 | D | 616.04 | C | 656.59 | B | 765.75 | A |
| 63 | 590.85 | D | 622.30 | C | 682.41 | B | 779.31 | A |
| 73 | 599.33 | D | 642.79 | C | 713.03 | B | 807.80 | A |

Note: Values correspond to averages of n = 3 samples per treatment. Different uppercase letters indicate significant differences between incubation temperatures at the same SOC contents ($p < 0.05$).

Supplementary Table S8. Changes in cumulative CO₂ production under SOC34 with incubation temperatures.

| Incubation temperature | 5 °C | | 15 °C | | 25 °C | | 35 °C | |
|------------------------|--------|---|--------|---|--------|---|--------|---|
| 1 | 87.52 | D | 119.41 | C | 144.64 | B | 208.34 | A |
| 3 | 158.73 | D | 189.63 | C | 212.89 | B | 283.74 | A |
| 5 | 211.08 | D | 243.47 | C | 268.09 | B | 338.93 | A |
| 7 | 260.04 | D | 278.68 | C | 329.54 | B | 392.13 | A |
| 14 | 346.37 | C | 357.55 | C | 406.06 | B | 435.14 | A |
| 21 | 407.01 | C | 420.57 | C | 454.84 | B | 514.52 | A |
| 28 | 448.62 | D | 470.59 | C | 523.70 | B | 576.75 | A |
| 35 | 507.34 | D | 529.71 | C | 560.96 | B | 646.38 | A |
| 42 | 533.66 | D | 567.59 | C | 605.60 | B | 712.67 | A |
| 49 | 565.34 | D | 599.29 | C | 649.66 | B | 754.92 | A |
| 56 | 586.72 | D | 621.01 | C | 664.77 | B | 784.64 | A |
| 63 | 609.54 | D | 641.60 | C | 705.48 | B | 799.26 | A |
| 73 | 624.05 | D | 657.97 | C | 733.55 | B | 821.50 | A |

Note: Values correspond to averages of n = 3 samples per treatment. Different uppercase letters indicate significant differences between incubation temperatures at the same SOC contents ($p < 0.05$).

Supplementary Table S9. Variations of cumulative CO₂ production in the SOC63 among incubation temperatures.

| Incubation temperature | 5 °C | | 15 °C | | 25 °C | | 35 °C | |
|------------------------|--------|---|--------|---|--------|---|---------|---|
| 1 | 120.48 | D | 143.33 | C | 174.23 | B | 245.70 | A |
| 3 | 202.55 | C | 228.08 | B | 241.20 | B | 332.87 | A |
| 5 | 250.97 | D | 281.01 | C | 305.50 | B | 389.83 | A |
| 7 | 305.55 | D | 328.60 | C | 373.48 | B | 436.29 | A |
| 14 | 370.33 | D | 409.09 | C | 453.52 | B | 516.22 | A |
| 21 | 444.25 | D | 466.99 | C | 510.97 | B | 603.17 | A |
| 28 | 502.92 | D | 529.99 | C | 567.86 | B | 696.66 | A |
| 35 | 554.44 | D | 587.37 | C | 642.18 | B | 778.82 | A |
| 42 | 582.80 | D | 617.21 | C | 681.88 | B | 837.41 | A |
| 49 | 613.74 | D | 657.80 | C | 707.24 | B | 893.69 | A |
| 56 | 626.07 | D | 677.57 | C | 728.22 | B | 937.01 | A |
| 63 | 648.71 | D | 701.00 | C | 750.19 | B | 963.48 | A |
| 73 | 659.32 | D | 718.82 | C | 785.44 | B | 1003.91 | A |

Note: Values correspond to averages of n = 3 samples per treatment. Different uppercase letters indicate significant differences between incubation temperatures at the same SOC contents ($p < 0.05$).

Supplementary Table S10. Changes in the Q_{10} values with SOC contents in soils.

| Incubation time | SOC10 | | SOC19 | | SOC29 | | SOC34 | | SOC63 | |
|-----------------|--------|----|--------|----|--------|----|--------|----|--------|---|
| 1 | 1.5295 | A | 1.4015 | AB | 1.3232 | B | 1.3239 | B | 1.2644 | B |
| 3 | 1.2863 | A | 1.2745 | AB | 1.2264 | BC | 1.2048 | CD | 1.1672 | D |
| 5 | 1.2154 | A | 1.187 | AB | 1.1639 | B | 1.1643 | B | 1.1508 | B |
| 7 | 1.1572 | AB | 1.1638 | A | 1.1435 | AB | 1.1502 | AB | 1.1272 | B |
| 14 | 1.1198 | A | 1.0924 | B | 1.0848 | B | 1.0847 | B | 1.1163 | A |
| 21 | 1.0835 | AB | 1.0827 | AB | 1.0731 | B | 1.0813 | AB | 1.1061 | A |
| 28 | 1.0857 | B | 1.0782 | B | 1.0875 | B | 1.0900 | AB | 1.1105 | A |
| 35 | 1.0717 | C | 1.086 | B | 1.0773 | BC | 1.0816 | BC | 1.1173 | A |
| 42 | 1.0719 | C | 1.0769 | BC | 1.0885 | BC | 1.0978 | B | 1.1261 | A |
| 49 | 1.0759 | C | 1.0774 | C | 1.0951 | B | 1.0995 | B | 1.1275 | A |
| 56 | 1.0849 | C | 1.0862 | BC | 1.0946 | BC | 1.0987 | B | 1.1368 | A |
| 63 | 1.0852 | B | 1.0837 | B | 1.0967 | B | 1.0951 | B | 1.1337 | A |
| 73 | 1.0831 | C | 1.0825 | C | 1.1051 | B | 1.0979 | B | 1.1446 | A |

Note: Values correspond to averages of $n = 3$ samples per treatment. Different uppercase letters indicate significant differences between SOC contents ($p < 0.05$).