**Table S1.** Soil percolate properties in the free drainage and flooded treatments at different times after adding amendments.

| Treatment | pH | Redox Potential (mV) | Absorbance 450 nm | Soluble Fe (mg Fe/L) | Sulphate (mg SO$_4^{2-}$/L) |
|---|---|---|---|---|---|
| 5 days | | | | | |
| FC | 3.86 ± 0.22 a | 314 ± 35 c | 10 ± 6 a | 18 ± 31 ab | 328 ± 241 a |
| FS | 4.52 ± 0.75 ab | 239 ± 82 bc | 34 ± 38 a | 69 ± 71 b | 367 ± 315 a |
| FM | 4.68 ± 0.68 b | 203 ± 83 ab | 12 ± 6 a | 16 ± 29 ab | 280 ± 153 a |
| FL | 6.73 ± 0.40 c | 129 ± 51 a | 93 ± 111 a | 0 ± 1 a | 388 ± 288 a |
| DC | 3.87 ± 0.23 a | 387 ± 46 b | 5 ± 2 a | 0 ± 0 a | 166 ± 126 a |
| DS | 4.23 ± 0.48 a | 312 ± 30 b | 11 ± 3 a | 65 ± 122 a | 324 ± 415 a |
| DM | 4.32 ± 0.40 a | 340 ± 59 b | 9 ± 1 a | 0 ± 0 a | 462 ± 333 a |
| DL | 7.04 ± 0.12 b | 213 ± 64 a | 30 ± 13 b | 0 ± 0 a | 471 ± 476 a |
| Two-way ANOVA | | | | | |
| F | *** | *** | ns | ns | ns |
| I | ns | *** | ns | ns | ns |
| F × I | ns | ns | ns | ns | ns |
| | | | | | |
| 12 days | | | | | |
| FC | 5.15 ± 0.38 a | 228 ± 43 b | 6 ± 2 a | 111 ± 131 b | 299 ± 290 a |
| FS | 6.32 ± 0.33 b | 57 ± 85 a | 41 ± 37 b | 0 ± 0 ab | 95 ± 17 a |
| FM | 6.04 ± 0.34 b | 154 ± 6 ab | 7 ± 3 a | 12 ± 13 ab | 390 ± 446 a |
| FL | 7.05 ± 0.31 c | 105 ± 77 a | 26 ± 13 ab | 0 ± 1 a | 439 ± 618 a |
| DC | 4.14 ± 0.37 a | 373 ± 51 b | 1 ± 1 a | 0 ± 0 a | 119 ± 45 a |
| DS | 4.93 ± 0.94 a | 326 ± 58 b | 6 ± 3 a | 24 ± 48 a | 168 ± 126 a |
| DM | 4.51 ± 0.60 a | 308 ± 72 b | 16 ± 15 a | 41 ± 59 a | 323 ± 336 a |
| DL | 7.46 ± 0.15 b | 192 ± 22 a | 36 ± 18 b | 0 ± 0 a | 466 ± 697 a |
| Two-way ANOVA | | | | | |
| F | *** | *** | ** | ns | ns |
| I | *** | *** | ns | ns | ns |
| F × I | ** | ns | * | ns | ns |
| | | | | | |
| 26 days | | | | | |
| FC | 5.07 ± 0.64 a | 282 ± 48 b | 106 ± 170 a | 115 ± 96 b | 154 ± 164 a |
| FS | 5.67 ± 0.56 ab | 198 ± 24 a | 176 ± 189 a | 50 ± 82 ab | 124 ± 198 a |
| FM | 6.12 ± 0.38 b | 185 ± 49 a | 412 ± 514 a | 16 ± 18 ab | 114 ± 163 a |
| FL | 7.86 ± 0.42 c | 151 ± 40 a | 97 ± 106 a | 2 ± 4 a | 259 ± 480 a |
| DC | 4.03 ± 0.25 a | 336 ± 40 b | 6 ± 4 a | 0 ± 0 a | 64 ± 49 a |
| DS | 4.86 ± 0.87 a | 274 ± 30 b | 6 ± 4 a | 0 ± 0 a | 55 ± 38 a |
| DM | 5.08 ± 0.91 a | 302 ± 61 b | 14 ± 14 ab | 0 ± 0 a | 82 ± 86 a |
| DL | 7.40 ± 0.81 b | 202 ± 30 a | 28 ± 12 b | 0 ± 0 a | 161 ± 268 a |
| Two-way ANOVA | | | | | |
| F | *** | *** | ns | ns | ns |
| I | *** | *** | * | ** | ns |
| F × I | ns | ns | ns | ns | ns |
| | | | | | |
| 40 days | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| FC | 5.96 ± 0.02 a | 247 ± 38 c | 28 ± 22 a | 21 ± 11 ab | 91 ± 89 a |
| FS | 6.28 ± 0.19 ab | 218 ± 26 bc | 525 ± 299 b | 22 ± 24 ab | 12 ± 17 a |
| FM | 6.48 ± 0.31 b | 190 ± 20 ab | 468 ± 482 ab | 45 ± 30 b | 63 ± 112 a |
| FL | 7.64 ± 0.19 c | 154 ± 9 a | 58 ± 29 a | 0 ± 1 a | 50 ± 77 a |
| DC | 4.06 ± 0.23 a | 345 ± 41 b | 3 ± 1 a | 0 ± 0 a | 47 ± 35 a |
| DS | 4.86 ± 0.56 a | 322 ± 58 ab | 8 ± 5 ab | 0 ± 0 a | 42 ± 27 a |
| DM | 5.10 ± 0.96 a | 312 ± 60 ab | 6 ± 4 ab | 0 ± 0 a | 66 ± 67 a |
| DL | 6.66 ± 0.89 b | 264 ± 26 a | 21 ± 19 b | 0 ± 0 a | 195 ± 364 a |
| Two-way ANOVA | | | | | |
| F | *** | *** | * | * | ns |
| I | *** | *** | ** | *** | ns |
| F × I | ns | ns | * | * | ns |
| | | | | | |
| **68 days** | | | | | |
| FC | 6.20 ± 0.53 a | 380 ± 54 b | 66 ± 53 a | 6 ± 7 a | 51 ± 43 b |
| FS | 6.21 ± 0.13 a | 278 ± 40 a | 879 ± 437 b | 42 ± 39 b | 2 ± 3 a |
| FM | 6.32 ± 0.10 a | 275 ± 28 a | 884 ± 910 b | 25 ± 25 ab | 21 ± 34 ab |
| FL | 7.10 ± 0.19 b | 253 ± 19 a | 128 ± 64 ab | 0 ± 0 a | 5 ± 4 a |
| DC | 4.21 ± 0.41 a | 371 ± 31 b | 1 ± 2 a | 0 ± 0 a | 36 ± 29 a |
| DS | 4.92 ± 0.72 a | 346 ± 57 ab | 1 ± 1 a | 0 ± 0 a | 20 ± 7 a |
| DM | 4.96 ± 0.58 a | 348 ± 19 ab | 8 ± 11 ab | 0 ± 0 a | 35 ± 30 a |
| DL | 6.55 ± 0.42 b | 294 ± 64 a | 23 ± 19 b | 0 ± 0 b | 40 ± 48 a |
| Two-way ANOVA | | | | | |
| F | *** | *** | * | ns | ns |
| I | *** | *** | *** | ** | ns |
| F × I | * | ns | * | ns | ns |
| | | | | | |
| **96 days** | | | | | |
| FC | 6.17 ± 0.14 a | 129 ± 32 a | 280 ± 238 a | 20 ± 7 a | 30 ± 36 a |
| FS | 6.29 ± 0.13 a | 105 ± 42 a | 437 ± 490 a | 51 ± 60 a | 5 ± 6 a |
| FM | 6.41 ± 0.13 a | 114 ± 38 a | 569 ± 640 a | 27 ± 27 a | 13 ± 18 a |
| FL | 7.19 ± 0.56 b | 143 ± 29 a | 203 ± 244 a | 7 ± 13 a | 7 ± 6 a |
| DC | 4.56 ± 0.53 a | 285 ± 57 a | 40 ± 66 a | 0 ± 0 a | 40 ± 37 a |
| DS | 5.39 ± 0.46 b | 260 ± 55 a | 9 ± 3 a | 0 ± 0 a | 22 ± 6 a |
| DM | 5.82 ± 0.60 b | 248 ± 62 a | 11 ± 4 a | 0 ± 0 a | 39 ± 34 a |
| DL | 6.66 ± 0.34 c | 222 ± 44 a | 36 ± 28 b | 0 ± 0 a | 26 ± 21 a |
| Two-way ANOVA | | | | | |
| F | *** | ns | ns | ns | ns |
| I | *** | *** | *** | *** | *** |
| F × I | ns | ns | ns | ns | ns |

Data are presented as the means of four replicates ($n = 4$). Different lowercase letters in a column indicate significant differences among amendment additions in the same water treatment type at each sampling time ($p < 0.05$). DC, DS, DM, and DL represent the treatments of control, straw, manure, and lime addition in the non-flooded treatment, respectively. FC, FS, FM, and FL denote the treatments of control, straw, manure, and lime addition in the flooded treatment, respectively. F, amendment treatment; I, water treatment; F × I, amendment treatment × water management; ns, $p > 0.05$; * represents $p < 0.05$, ** represents $p < 0.01$, *** represents $p < 0.001$.

**Table S2.** Soil properties in the flooded treatments during the second incubation at different times after adding amendments.

| Treatment | pH | Redox Potential (mV) | Biological Activity (mg C-CO$_2$/kg dw Day |
|---|---|---|---|
| **4 h** | | | |
| FC | | | 0.00 ± 0.00 a |
| FS | | | 21.68 ± 10.69 a |
| FM | | | 301.68 ± 29.19 b |
| FB | | | 344.04 ± 124.47 c |
| One-way ANOVA | | | *** |
| | | | |
| **1 day** | | | |
| FC | 3.90 ± 0.17 ab | 476 ± 16 b | 2.10 ± 2.30 a |
| FS | 4.00 ± 0.21 a | 338 ± 113 a | 24.68 ± 9.56 b |
| FM | 4.56 ± 0.31 bc | 395 ± 48 a | 87.68 ± 6.479 c |
| FB | 4.85 ± 0.38 c | 403 ± 37 ab | 136.45 ± 12.48 d |
| One-way ANOVA | ** | ** | *** |
| | | | |
| **2 days** | | | |
| FC | 3.88 ± 0.17 a | 438 ± 24 c | 10.16 ± 4.27 a |
| FS | 4.05 ± 0.21 a | 239 ± 55 a | 64.26 ± 23.62 b |
| FM | 4.46 ± 0.28 b | 376 ± 20 b | 108.16 ± 9.25 c |
| FB | 4.79 ± 0.34 c | 383 ± 30 b | 146.23 ± 14.38 d |
| One-way ANOVA | *** | *** | *** |
| | | | |
| **5 days** | | | |
| FC | 3.92 ± 0.16 a | 404 ± 29 c | 7.79 ± 3.27 a |
| FS | 4.53 ± 0.47 b | 64 ± 99 a | 46.41 ± 20.60 c |
| FM | 4.49 ± 0.29 b | 327 ± 13 b | 29.21 ± 4.04 b |
| FB | 4.78 ± 0.30 c | 347 ± 18 bc | 27.96 ± 1.79 b |
| One-way ANOVA | *** | ** | *** |
| | | | |
| **7 days** | | | |
| FC | 3.86 ± 0.16 a | 400 ± 19 c | 16.37 ± 10.46 a |
| FS | 4.61 ± 0.42 b | 102 ± 76 a | 83.97 ± 6.16 c |
| FM | 4.45 ± 0.26 b | 328 ± 18 b | 35.89 ± 5.16 b |
| FB | 4.70 ± 0.30 b | 350 ± 18 b | 32.04 ± 5.16 b |
| One-way ANOVA | *** | *** | *** |
| | | | |
| **12 days** | | | |
| FC | 3.83 ± 0.17 a | 406 ± 18 b | 7.07 ± 2.57 a |
| FS | 4.74 ± 0.87 b | 115 ± 179 a | 37.89 ± 13.16 b |
| FM | 4.41 ± 0.25 b | 323 ± 46 b | 14.32 ± 2.74 a |
| FB | 4.62 ± 0.27 b | 361 ± 30 b | 11.06 ± 3.40 a |
| One-way ANOVA | * | *** | *** |
| | | | |
| **16 days** | | | |
| FC | 3.89 ± 0.16 a | 412 ± 29 b | 8.77 ± 2.96 a |
| FS | 4.81 ± 1.04 b | 127 ± 179 a | 49.10 ± 30.48 b |
| FM | 4.49 ± 0.27 ab | 346 ± 38 b | 15.58 ± 4.44 a |
| FB | 4.68 ± 0.29 a | 377 ± 28 b | 11.35 ± 4.33 a |

| | | | |
|---|---|---|---|
| One-way ANOVA | * | *** | *** |
| **19 days** | | | |
| FC | 3.87 ± 0.16 a | 419 ± 22 b | 9.77 ± 3.55 a |
| FS | 4.78 ± 1.08 b | 148 ± 181 a | 28.38 ± 42.22 b |
| FM | 4.45 ± 0.26 ab | 349 ± 35 b | 16.49 ± 4.64 a |
| FB | 4.67 ± 0.29 b | 369 ± 22 b | 11.83 ± 5.03 a |
| One-way ANOVA | ns | *** | *** |
| **23 days** | | | |
| FC | 3.84 ± 0.16 a | 418 ± 22 b | 6.91 ± 2.67 a |
| FS | 4.80 ± 1.18 b | 140 ± 207 a | 38.78 ± 26.68 b |
| FM | 4.43 ± 0.27 ab | 345 ± 32 b | 11.53 ± 3.07 a |
| FB | 4.64 ± 0.31 b | 364 ± 22 b | 8.25 ± 3.05 a |
| One-way ANOVA | ns | ** | ** |
| **28 days** | | | |
| FC | 3.84 ± 0.16 a | 430 ± 25 b | 6.63 ± 2.67 a |
| FS | 4.85 ± 1.24 b | 112 ± 177 a | 32.94 ± 18.48 b |
| FM | 4.40 ± 0.27 ab | 353 ± 34 b | 10.15 ± 2.78 a |
| FB | 4.61 ± 0.30 ab | 377 ± 27 b | 7.09 ± 2.80 a |
| One-way ANOVA | ns | *** | *** |
| **35 days** | | | |
| FC | 3.78 ± 0.17 a | 423 ± 22 b | 5.98 ± 2.89 a |
| FS | 5.00 ± 1.26 b | 59 ± 208 a | 32.11 ± 15.985 b |
| FM | 4.36 ± 0.26 ab | 359 ± 42 b | 9.14 ± 2.41 a |
| FB | 4.56 ± 0.29 ab | 381 ± 33 b | 6.51 ± 3.45 a |
| One-way ANOVA | * | *** | *** |
| **42 days** | | | |
| FC | 3.77 ± 0.18 a | 425 ± 38 b | 6.38 ± 2.87 a |
| FS | 5.18 ± 1.09 c | 28 ± 174 a | 36.02 ± 13.72 b |
| FM | 4.37 ± 0.27 ab | 346 ± 42 b | 10.42 ± 2.55 a |
| FB | 4.54 ± 0.29 bc | 364 ± 41 b | 7.97 ± 3.53 a |
| One-way ANOVA | ** | *** | *** |

Data are presented as the means of six replicates ($n$ = 6). Different lowercase letters in a column indicate significant differences among amendment additions at each sampling time ($p < 0.05$). FC, FS, FM, and FB denote the treatments of control, straw, manure, and biochar addition in the flooded treatment, respectively. Ns, $p > 0.05$; * represents $p < 0.05$, ** represents $p < 0.01$, *** represents $p < 0.001$.