**Supplementary materials**

**Table S1** Soil properties under different fertilization treatments before early rice transplanting in 2017.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **CK** | **N** | **NPK** | **OM** | **NO** | **NPKO** | **NPKS** |
| **SOC**  **(g kg-1)** | 7.97 b | 9.49 ab | 10.69 a | 10.92 a | 12.26 a | 11.52 a | 11.19 a |
| **pH** | 5.25 a | 5.18 a | 5.36 a | 5.34 a | 5.30 a | 5.33 a | 5.36 a |
| **CEC**  **(mg kg-1)** | 13.9 ab | 13.8 ab | 12.8 b | 13.9 ab | 14.4 ab | 14.1 ab | 15.0 a |
| **TN**  **(g kg-1)** | 0.83 c | 0.98 bc | 1.13 ab | 1.17 ab | 1.28 a | 1.24 a | 1.17 ab |
| **TP**  **(g kg-1)** | 0.30 d | 0.30 d | 0.60 b | 0.43 c | 0.43 c | 0.71 a | 0.56 b |
| **TK**  **(g kg-1)** | 16.8 a | 15.9 a | 15.7 a | 16.0 a | 15.5 a | 15.7 a | 15.4 a |
| **AN**  **(mg kg-1)** | 62.8 c | 73.9 bc | 83.9 abc | 86.5 abc | 99.5 a | 101.5 a | 88.3 ab |
| **AP**  **(mg kg-1)** | 2.79 d | 2.38 d | 25.9 b | 9.27 c | 8.23 c | 41.7 a | 32.0 b |
| **AK**  **(mg kg-1)** | 126.7 a | 97.3 ab | 70.0 b | 89.7 ab | 82.7 ab | 88.7 ab | 78.0 b |
| **MBC**  **(mg kg-1)** | 186.2 d | 242.0 d | 402.3 ab | 361.2 b | 413.5 ab | 422.6 a | 378.9 ab |
| **AWCD** | 0.17 a | 0.20 ab | 0.29 a | 0.24 ab | 0.25 ab | 0.30 a | 0.22 ab |
| **Shannon** | 2.79 c | 2.83 bc | 2.98 ab | 3.03 a | 2.95 ab | 2.95 ab | 2.89 abc |

CK, without fertilization; N and NPK, mineral N and NPK fertilizers; OM, straw return and pig manure; NO, OM plus N fertilizer; NPKO, mineral NPK fertilizers plus OM; NPKS, mineral NPK fertilizers plus half amount of straw returen. SOC, soil organic carbon; CEC, cation exchange capacity; TN, TP and TK, soil total nitrogen, total phosphorus, and total potassium; AN, AP, AK, available nitrogen, available phosphorus and available potassium; MBC, microbial biomass carbon; AWCD and Simpson index were calculated from BIOLOG method. Data are means of 3 replicates. Small letters in each row indicate significant difference among different treatments at the 0.05 probability level according to Duncan’s multiple comparison test.