**Supplementary Information**

Table S1. Summary of the RM-ANOVAs for the greenhouse gas emissions and dissolved for the various amendments.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | *df* | *MS* | *F* | *P* |
| **CO2 emmission** |  |  |  |  |
| Fertilizer amount | 2, 6 | 145697.265 | 0.634 | 0.563 |
| Time | 13, 78 | 6584648.924 | 100.743 | <0.001 |
| Fertilizer amount× Time | 26, 78 | 53321.46 | 0.816 | 0.214 |
| **CH4 emmission** |  |  |  |  |
| Fertilizer amount | 2, 6 | 19.707 | 0.524 | 0.617 |
| Time | 13, 78 | 71.640 | 8.642 | <0.001 |
| Fertilizer amount× Time | 26, 78 | 2.859 | 0.345 | 0.998 |
| **N2Oemmission** |  |  |  |  |
| Fertilizer amount | 2, 6 | 2132.606 | 0.551 | 0.603 |
| Time | 13, 78 | 36580.543 | 6.255 | <0.001 |
| Fertilizer amount× Time | 26, 78 | 4896.161 | 0.837 | 0.688 |
| **Dissolved CO2** |  |  |  |  |
| Fertilizer amount | 2, 6 | 1242971.341 | 32.017 | 0.001 |
| Time | 12, 72 | 435471.462 | 21.659 | <0.001 |
| Fertilizer amount× Time | 24, 72 | 96241.632 | 4.787 | <0.001 |
| **Dissolved CH4** |  |  |  |  |
| Fertilizer amount | 2, 6 | 4.156 | 0.185 | 0.835 |
| Time | 12, 72 | 73.648 | 5.865 | <0.001 |
| Fertilizer amount× Time | 24, 72 | 11.750 | 0.936 | 0.556 |
| **Dissolved N2O** |  |  |  |  |
| Fertilizer amount | 2, 6 | 0.010 | 1.461 | 0.304 |
| Time | 12, 72 | 0.021 | 2.644 | 0.005 |
| Fertilizer amount× Time | 24, 72 | 0.011 | 1.309 | 0.190 |

Table S2. Summary of the RM-ANOVAs for the soil and porewater properties for the various amendments.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | *df* | *MS* | *F* | *P* |
| **Soil pH** |  |  |  |  |
| Fertilizer amount | 2, 6 | 0.008 | 0.357 | 0.714 |
| Time | 13, 78 | 9.404 | 1081.928 | <0.001 |
| Fertilizer amount× Time | 26, 78 | 0.044 | 5.118 | <0.001 |
| **Soil Eh** |  |  |  |  |
| Fertilizer amount | 2, 6 | 117.162 | 0.005 | 0.995 |
| Time | 13, 78 | 24136.034 | 7.197 | <0.001 |
| Fertilizer amount× Time | 26, 78 | 112.619 | 0.034 | 1.000 |
| **Soil salinity** |  |  |  |  |
| Fertilizer amount | 2, 6 | 0.082 | 2.411 | 0.170 |
| Time | 13, 78 | 0.534 | 46.778 | <0.001 |
| Fertilizer amount× Time | 26, 78 | 0.013 | 1.180 | 0.283 |
| **Soil temperature** |  |  |  |  |
| Fertilizer amount | 2, 6 | 0.086 | 1.620 | 0.274 |
| Time | 13, 78 | 90.042 | 798.691 | <0.001 |
| Fertilizer amount× Time | 26, 78 | 0.195 | 1.733 | 0.033 |
| **Soil water content** |  |  |  |  |
| Fertilizer amount | 2, 6 | 12.948 | 0.425 | 0.672 |
| Time | 13, 78 | 1165.077 | 169.083 | <0.001 |
| Fertilizer amount× Time | 26, 78 | 22.650 | 3.287 | <0.001 |
| **Porewater NH4+** |  |  |  |  |
| Fertilizer amount | 2, 6 | 88.148 | 2.219 | 0.190 |
| Time | 12, 72 | 126.980 | 5.900 | <0.001 |
| Fertilizer amount× Time | 24, 72 | 22.278 | 1.035 | 0.437 |
| **Porewater NO3-** |  |  |  |  |
| Fertilizer amount | 2, 6 | 0.352 | 0.137 | 0.874 |
| Time | 12, 72 | 4.376 | 2.772 | 0.004 |
| Fertilizer amount× Time | 24, 72 | 3.456 | 2.189 | 0.006 |
| **Porewater TN** |  |  |  |  |
| Fertilizer amount | 2, 6 | 21.456 | 0.477 | 0.643 |
| Time | 12, 72 | 98.312 | 12.728 | <0.001 |
| Fertilizer amount× Time | 24, 72 | 14.055 | 1.820 | 0.027 |
| **Porewater TP** |  |  |  |  |
| Fertilizer amount | 2, 6 | 14.269 | 0.809 | 0.488 |
| Time | 12, 72 | 23.489 | 2.553 | 0.007 |
| Fertilizer amount× Time | 24, 72 | 7.903 | 0.859 | 0.652 |
| **Porewater DOC** |  |  |  |  |
| Fertilizer amount | 2, 6 | 67.440 | 0.699 | 0.534 |
| Time | 12, 72 | 1486.292 | 30.467 | <0.001 |
| Fertilizer amount× Time | 24, 72 | 25.075 | 0.514 | 0.965 |

Table S3. Correlations between the soil properties, soil nutrient concentrations, greenhouse-gas emissions and dissolved porewater greenhouse-gas concentrations.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variable | Soil properties | | | | | Porewater nutrient concentrations | | | | |
| pH | Eh | Salinity | Temperature | Water content | NH4+ | NO3- | TN | TP | DOC |
| **CO2 emission** |  |  |  |  |  |  |  |  |  |  |
| Control | -0.392\*\* | 0.347\* | -0.035 | 0.681\*\* | 0.398\*\* | -0.382\*\* | 0.433\*\* | -0.396\*\* | -0.246 | -0.655 |
| Standard fertilization | -0.322\* | 0.360\* | -0.064 | 0.670\*\* | 0.359\* | -0.415\*\* | -0.064 | -0.442\*\* | -0.308\* | -0.531\*\* |
| Double fertilization | -0.366\*\* | 0.421\*\* | -0.282\* | 0.709\*\* | 0.180 | -0.408\*\* | -0.191 | -0.456\*\* | -0.287\* | -0.572\*\* |
| Total treatment | -0.357\*\* | 0.372\*\* | -0.118 | 0.683\*\* | 0.309\*\* | -0.340\*\* | -0.051 | -0.406\*\* | -0.232\*\* | -0.585\*\* |
| **CH4 emission** |  |  |  |  |  |  |  |  |  |  |
| Control | 0.272\* | -0.142 | 0.374\*\* | -0.234 | 0.355\* | -0.216 | -0.078 | -0.030 | -0.065 | -0.156 |
| Standard fertilization | 0.297\* | -0.217 | 0.610\*\* | -0.332\* | 0.647\*\* | -0.315\* | -0.092 | -0.244 | -0.047 | -0.151 |
| Double fertilization | 0.215 | -0.209 | 0.506\*\* | -0.232 | 0.486\*\* | -0.088 | -0.176 | -0.245 | -0.146 | -0.029 |
| Total treatment | 0.251\*\* | -0.186\* | 0.495\*\* | -0.253\*\* | 0.471\*\* | -0.108 | -0.122 | -0.166 | -0.081 | -0.117 |
| **N2O emission** |  |  |  |  |  |  |  |  |  |  |
| Control | -0.142 | -0.136 | -0.063 | -0.018 | -0.093 | 0.059 | 0.132 | 0.249 | -0.002 | 0.126 |
| Standard fertilization | -0.345\* | 0.004 | -0.247 | 0.089 | -0.323\* | 0.304\* | -0.063 | 0.359\* | 0.116 | 0.233 |
| Double fertilization | -0.301\* | -0.198 | 0.060 | -0.007 | 0.011 | 0.013 | 0.098 | 0.202 | 0.153 | 0.058 |
| Total treatment | -0.235\*\* | -0.127 | -0.062 | 0.009 | -0.095 | 0.059 | 0.067 | 0.215\* | 0.092 | 0.126 |
| **Dissolved porewater CO2 concentration** |  |  |  |  |  |  |  |  |  |  |
| Control | 0.257 | 0.031 | 0.590\*\* | -0.070 | 0.705\*\* | -0.346 | 0.082 | -0.154 | -0.097 | -0.314 |
| Standard fertilization | -0.157 | 0.157 | 0.019 | 0.185 | 0.286\* | -0.129 | -0.129 | -0.118 | -0.169 | -0.249 |
| Double fertilization | 0.289\* | 0.076 | 0.259 | 0.019 | 0.623\*\* | -0.346\* | -0.107 | -0.420\*\* | -0.298\* | -0.239 |
| Total treatment | 0.123 | 0.070 | 0.278\*\* | 0.045 | 0.460\*\* | -0.173\* | -0.064 | -0.220\*\* | -0.160\* | -0.230\*\* |
| **Dissolved porewater CH4 concentration** |  |  |  |  |  |  |  |  |  |  |
| Control | -0.074 | 0.302\* | 0.361\* | 0.228 | 0.548\*\* | -0.335\* | 0.337\* | -0.145 | -0.170 | -0.342\* |
| Standard fertilization | -0.278\* | 0.300\* | 0.022 | 0.189 | 0.170 | -0.141 | -0.022 | -0.099 | -0.079 | -0.018 |
| Double fertilization | 0.014 | 0.033 | 0.183 | 0.090 | 0.248 | -0.165 | -0.055 | -0.160 | -0.149 | 0.124 |
| Total treatment | -0.143 | 0.231\*\* | 0.142 | 0.170\* | 0.284\*\* | -0.146 | 0.010 | -0.118 | -0.096 | -0.082 |
| **Dissolved porewater N2O concentration** |  |  |  |  |  |  |  |  |  |  |
| Control | -0.146 | 0.152 | -0.027 | -0.191 | -0.120 | 0.193 | 0.249 | 0.530\*\* | 0.166 | -0.089 |
| Standard fertilization | -0.083 | -0.024 | -0.125 | -0.283\* | -0.262 | 0.351\* | 0.488\*\* | 0.420\*\* | 0.162 | 0.028 |
| Double fertilization | 0.284\* | 0.099 | 0.049 | -0.326\* | -0.075 | 0.185 | 0.028 | -0.058 | -0.107 | 0.340\* |
| Total treatment | 0.056 | 0.051 | -0.009 | -0.268\*\* | -0.148 | 0.260\*\* | 0.131 | 0.191\* | 0.001 | 0.109 |

\*, significant at *P*<0.05; \*\*, significant at *P*<0.01. Each treatment, greenhouse-gas emissions with soil properties: n=42, total treatment: n=126; greenhouse-gas emissions with soil nutrient concentrations: n=39, total treatment: n=117; dissolved porewater greenhouse-gas concentrations with soil properties and nutrient concentrations: n=39, total treatment: n=117.

Table S4. Correlations between the greenhouse-gas emissions and dissolved porewater greenhouse-gas concentrations.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | CH4 emission | N2O emission | Dissolved CO2 | Dissolved CH4 **concentration** | Dissolved N2O **concentration** |
| CO2 emission | 0.157\* | -0.019 | 0.276\*\* | - | - |
| CH4 emission |  | -0.076 | - | 0.408\*\* | - |
| N2O emission |  |  | - | - | -0.140 |
| Dissolved porewater CO2 **concentration** |  |  |  | 0.377\*\* | 0.130 |
| Dissolved porewater CH4 **concentration** |  |  |  |  | -0.062 |

\*, significant at *P*<0.05; \*\*, significant at *P*<0.01. Correlation of greenhouse-gas emission: n=126; greenhouse-gas emissions with dissolved porewater greenhouse-gas concentrations: n=117; correlation of dissolved porewater greenhouse-gas concentrations: n=117; -, correlation not determined.



Figure S1. Temporal variation of air temperature (A) and humidity (B) in the study site.