Table S1 The detailed tillage information under each treatment

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| Treatment | Tillage in wheat season | Tillage in maize season |
| RT-NT | Rotary tillage | All straw was returned to the field after mechanical harvesting of wheat. The maize-no-tillage seeder was used for simultaneous sowing of seed and fertilizer (sowing maize next to crop stubble). |
| RT-SBR | All wheat straw was returned to the field after mechanical harvest. The subsoiler was used for subsoiling in the field. Seed and fertilizer were sown simultaneously with a maize seeder, and maize was sown between subsoiling furrows. |
| RT-SIR | All straw was returned to the field after mechanical harvesting of wheat. The subsoiler was used for subsoiling in the field. Seed and fertilizer were sown simultaneously with a maize seeder, and maize was sown in subsoiling furrows. |
| DT-NT | Deep tillage | All straw was returned to the field after mechanical harvesting of wheat. The maize-no-tillage seeder was used for simultaneous sowing of seed and fertilizer (sowing maize next to crop stubble). |
| DT-SBR | All wheat straw was returned to the field after mechanical harvest. The subsoiler was used for subsoiling in the field. Seed and fertilizer were sown simultaneously with a maize seeder, and maize was sown between subsoiling furrows. |
| DT-SIR | All straw was returned to the field after mechanical harvesting of wheat. The subsoiler was used for subsoiling in the field. Seed and fertilizer were sown simultaneously with a maize seeder, and maize was sown in subsoiling furrows. |

Table S2 Varieties of wheat and maize and fertilization

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| Variety | Base fertilizer (kg ha-1) | topdressing（urea）(kg ha-1) |
| Zhengmai 369 | 750（N: P2O5: K2O=20:16:16） | 150（N 69） |
| Jundan 29 | 750（N: P2O5: K2O=28:10:12） | 0 |