Table S1. Different specific ways of straw returning to the field.

Treatment	Treatment Methods for Straw Returning Residues to the Field
Deep plowing and straw returning B	During mechanical harvesting, crop residues are pulverized, resulting in straw lengths of less than or equal to 10 centimeters. Before soil freezing, the field is deeply plowed using a fence-type five-furrow plow at a depth of 25-35 centimeters. Following the plowing, the field is harrowed once for further refinement.
Rotary tillage and straw returning RT	The deep plowing is once every two years, with the intervening years employing a no-till method using a flat planting technique with a no-till machine.
Crushing and mixing straw returning TM	During mechanical harvesting in the autumn, all straw residues are pulverized to lengths less than or equal to 10 centimeters and spread on the ground surface. Subsequently, a combined soil preparation machine is utilized to mix the straw within the soil layer of 0-20 centimeters. In the absence of a combined soil preparation machine, a deep loosening machine and disc harrow are employed for two passes to achieve effective mixing of straw and soil.
Pulverized cover straw returning C	During mechanical harvesting in the autumn, all straw is completely pulverized and spread to cover the ground surface, with the pulverized length being less than or equal to 10 centimeters. In the spring, a straw shredder is employed for a second operation to further pulverize the straw.
High stubble retention straw returning LHS	During mechanical harvesting in the autumn, a stubble height of 40-45 centimeters is retained, and the upper portion of the straw is completely pulverized and spread on the ground surface. In the spring, a straw shredder is used for a second operation to further pulverize the straw before seeding.
Strip cover S	After the straw is spread to cover the ground, the two rows of straw are consolidated into a single row for coverage.
Flat no-tillage without straw returning CK	After the autumn harvest, all straw is mechanically baled and removed from the field.

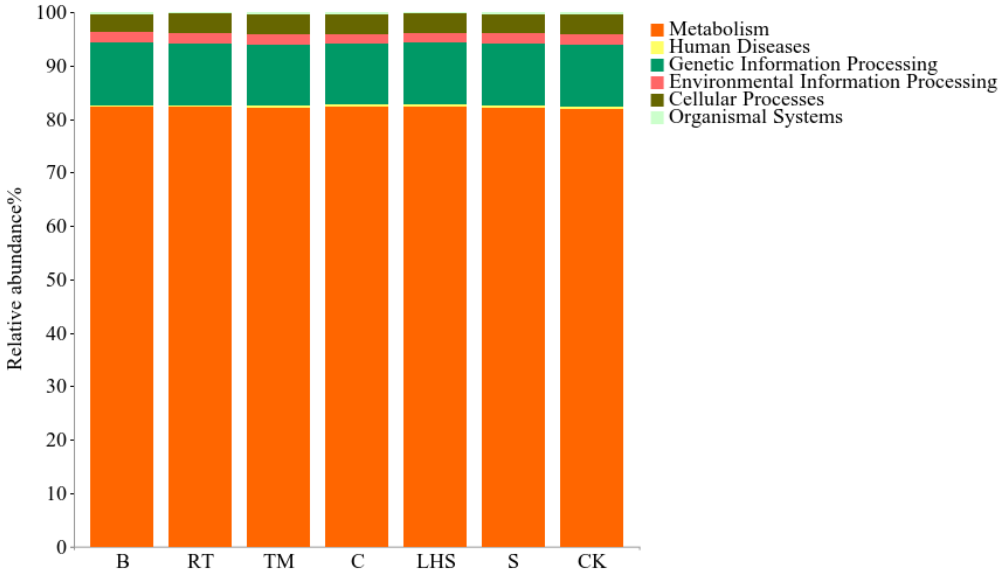


Figure S1. Illustrates the predicted potential functions of bacterial communities in soil under various methods of crop residue incorporation according to the KEGG database.