

Appendix A Soil sample groups under four cropping systems in China. The light blue dot represented the sampling sites.

Appendix B Soil sample groups, geographic location and soil physicochemical properties under four cropping systems in China.

Cropping system	Sample	Geographic location	Long. ¹⁾	Lat. ²⁾	pH ³⁾	P ⁴⁾ %	N ⁵⁾ %	K ⁶⁾ %	SOM ⁷⁾ g/kg
Maize continuous cropping	HLJ.18	Harbin, Heilongjiang	125.42E	44.04N	6.17	0.08	0.09	2.09	45.37
	JL.1	Changchun, Jilin	123.02 E	43.11 N	5.47	0.05	0.11	1.82	18.23
	LN.23	Shenyang, Liaoning	123.26 E	41.48 N	5.20	0.10	0.11	2.06	21.73
Average	-	-			5.61 ^a	0.08 ^a	0.10 ^a	1.99 ^a	28.44 ^a
Wheat-maize rotation	SD.3	Jinan, Shandong	117.00 E	36.40 N	8.03	0.07	0.07	1.69	7.71
	SX.17	Yangling, Shanxi	108.08 E	34.27 N	8.10	0.12	0.14	2.04	20.2
	AH.20	Hefei, Anhui	116.41 E	30.57 N	6.70	0.05	0.11	1.60	14.07
	HB.2	Wuhan, Hubei	113.41 E	29.58 N	7.20	0.07	0.10	1.25	12.57
	HeNXXQLY.2	Qiliying town, Xinxiang, Henan	113.80 E	35.16 N	7.97	0.11	0.11	1.72	16.13
	HeNXXQX.12	Guandi town, Xinxiang, Henan	113.94 E	35.28 N	8.70	0.09	0.12	1.87	21.13
	JS.13	Nanjing, Jiangsu	118.46 E	31.14 N	7.43	0.16	0.17	1.47	31.7
HuN.6	Changsha, Hunan	111.53 E	27.51 N	7.47	0.14	0.13	2.13	16.53	
Average	-	-			7.70 ^b	0.10 ^{ab}	0.12 ^a	1.72 ^a	17.51 ^a
Oil seed-maize rotation	FJFZ.21	Fuzhou, Fujian	118.08 E	25.15 N	5.70	0.28	0.13	2.64	20.73
	FJND.24	Ningde, Fujian	118.32 E	26.18 N	6.50	0.16	0.16	1.98	25.77
	JX.4	Nanchang, Jiangxi	116.41 E	30.57 N	5.73	0.14	0.17	1.16	25.57
	SC.7	Chengdu, Sichuan	102.54 E	30.05 N	5.80	0.11	0.16	2.11	23.67
Average	-	-			5.93 ^a	0.17 ^b	0.16 ^a	1.97 ^a	23.94 ^a
Potato-maize rotation	NMG.9	Wulumuqi, Xinjiang	110.46 E	30.51 N	8.80	0.07	0.12	1.86	20.70
	QH.5	Xining, Qinghai	101.77 E	36.62 N	8.23	0.09	0.11	1.63	20.47
	XJ.15	Wulumuqi, Xinjiang	86.37 E	42.45 N	8.03	0.09	0.10	2.10	17.60
	YN.19	Kunming, Yunnan	102.10 E	24.23 N	5.77	0.11	0.24	1.79	48.47
	GS.11	Lanzhou, Gansu	103.40 E	36.03 N	8.50	0.10	0.10	1.87	14.37
	GX.14	Nanning, Guanxi	107.45 E	22.13 N	8.03	0.25	0.15	0.40	42.33
	GZ.8	Guiyang, Guizhou	106.07 E	26.11 N	7.60	0.09	0.18	1.14	34.30
Average	-	-			7.85 ^b	0.11 ^{ab}	0.14 ^a	1.54 ^a	28.32 ^a

¹⁾Long., Longitude. ²⁾Lat., Latitude. ³⁾pH, soil pH. ⁴⁾P, total phosphorus. ⁵⁾N, total nitrogen. ⁶⁾K, total potassium. ⁷⁾SOM, soil organic matter. Different letters indicate significant differences at the 0.05 level.

Appendix C Metagenomic sequencing statistics

	Sample ²⁾	Minimum	Maximum	Total	Average
Clean reads	Counts	30,445,380	44,477,119	756,026,722	34,364,851
	Total length (Mb)	4,524.17	6,602.05	112,163.04	5,098.32
	>Q30%	91.83%	94.85%	-	93.99%
	GC%	59.70%	63.48%	-	61.91%
Scafflod	Counts	384,053	2,235,637	19,894,336	904,288
Scaftig	Counts	6,681	153,007	936,408	42,564
	Length (bp)	500	221,608	18,392	836
	GC%	50.96%	66.90%	-	60.22%
ORF ¹⁾	Counts	8,666	219,494	1,253,426	56,974
	Length (bp)	201	8,754	12,309	560
	GC%	52.69%	67.23%	-	60.94%

¹⁾ ORF, open reading frames. ²⁾ Q30: Phred quality score (Q score), metric used to assess the accuracy of a sequencing Platform. Phred assigns a Q score of 30 (Q30) to a base, this is equivalent to the probability of an incorrect base call 1 in 1000 times.

Appendix D Taxa in the metagenome at family and genus level

Metagenome-Family /315	Metagenome-Genus/1497
Acetobacteraceae	Acaricomes
Acidaminococcaceae	Acaryochloris
Acidimicrobiaceae	Acetobacter
Acidithiobacillaceae	Acetobacterium
Acidobacteriaceae	Acetohalobium
Acidothermaceae	Acetonema
Actinomycetaceae	Achromatium
Actinopolysporaceae	Achromobacter
Actinospicaceae	Acidaminococcus
Aerococcaceae	Acidianus
Aeromonadaceae	Acidibacillus
Akkermansiaceae	Acidihalobacter
Alcaligenaceae	Acidimicrobium
Alcanivoraceae	Acidiphilium
Algiphilaceae	Acidiplasma
Alicyclobacillaceae	Acidisphaera
Alteromonadaceae	Acidithiobacillus
Amoebophilaceae	Acidithrix
Anaerolineaceae	Acidobacterium
Anaeromyxobacteraceae	Acidocella
Anaplasmataceae	Acidomonas
Aquificaceae	Acidothermus
Ardenticatenaceae	Acidovorax
Atopobiaceae	Aciduliprofundum
Aurantimonadaceae	Acinetobacter
Bacillaceae	Actibacterium
Bacillales Family X. Incertae Sedis	Actinoallomurus
Bacteriovoraceae	Actinoalloteichus
Bacteroidaceae	Actinobacillus
Balneolaceae	Actinocatenispora
Bartonellaceae	Actinokineospora
Bdellovibrionaceae	Actinomadura
Beijerinckiaceae	Actinomyces
Beutenbergiaceae	Actinomycetospora
Bifidobacteriaceae	Actinoplanes
Bogoriellaceae	Actinopolymorpha
Brachyspiraceae	Actinopolyspora
Bradyrhizobiaceae	Actinospica
Brevibacteriaceae	Actinosynnema
Brucellaceae	Actinotalea
Burkholderiaceae	Adhaeribacter
Caldicoprobacteraceae	Advenella
Caldilineaceae	Aequorivita
Caldiseriaceae	Aeribacillus
Campylobacteraceae	Aerococcus
Candidatus Brocadiaceae	Aeromicrobium
Candidatus Paracaedibacteraceae	Aeromonas
Cardiobacteriaceae	Aeropyrum
Carnobacteriaceae	Aestuariatibacter
Catabacteriaceae	Aestuariatimicrobium
Catenulisporaceae	Aestuariativita
Caulobacteraceae	Afifella

Cellulomonadaceae	Afipia
Cellvibrionaceae	Agarivorans
Chitinispirillaceae	Aggregatibacter
Chitinophagaceae	Agreia
Chlamydiaceae	Agrobacterium
Chlorobiaceae	Agrococcus
Chloroflexaceae	Agromyces
Chromatiaceae	Ahrensia
Chromobacteriaceae	Akkermansia
Chrysiogenaceae	Alcaligenes
Chthoniobacteraceae	Alcanivorax
Chthonomonadaceae	Algibacter
Clostridiaceae	Algicola
Clostridiales Family XIII. Incertae Sedis	Algiphilus
Clostridiales Family XVII. Incertae Sedi	Algoriphagus
Colwelliaceae	Aliagarivorans
Comamonadaceae	Alicycliphilus
Competibacteraceae	Alicyclobacillus
Conexibacteraceae	Aliiglaciicola
Coriobacteriaceae	Aliihoeflea
Corynebacteriaceae	Aliiroseovarius
Coxiellaceae	Aliivibrio
Criblamydiaceae	Alishewanella
Crocinitomicaceae	Alistipes
Cryomorphaceae	Aliterella
Cryptosporangiaceae	Alkaliflexus
Cyclobacteriaceae	Alkalilimnicola
Cystobacteraceae	Alkaliphilus
Cytophagaceae	Alkanindiges
Deferribacteraceae	Alloactinosynnema
Defluviitaleaceae	Allochromatium
Dehalococcoidaceae	Allokutzneria
Deinococcaceae	Alloprevotella
Demequinaceae	Allosalinactinospora
Dermabacteraceae	Alphabaculovirus
Dermacoccaceae	Altererythrobacter
Dermatophilaceae	Alteromonas
Desulfarculaceae	Altibacter
Desulfobacteraceae	Amantichitinum
Desulfobulbaceae	Aminiphilus
Desulfohalobiaceae	Aminobacter
Desulfomicrobiaceae	Aminobacterium
Desulfonatronaceae	Aminomonas
Desulfovibrionaceae	Ammonifex
Desulfurellaceae	Amorphus
Desulfurobacteriaceae	Amycolatopsis
Desulfuromonadaceae	Amycoliticoccus
Dictyoglomaceae	Anabaena
Dietziaceae	Anaeroarcus
Ectothiorhodospiraceae	Anaerobacillus
Eggerthellaceae	Anaerobaculum
Elusimicrobiaceae	Anaerococcus
Endomicrobiaceae	Anaeroglobus
Enterobacteriaceae	Anaerolinea
Enterococcaceae	Anaeromusa
Erysipelotrichaceae	Anaeromyxobacter

Erythrobacteraceae	Anaerophaga
Eubacteriaceae	Anaerosalibacter
Ferrimonadaceae	Anaerosporomusa
Ferrovaceae	Anaerostipes
Fervidobacteriaceae	Anaerotruncus
Fimbriimonadaceae	Anaerovibrio
Flammeovirgaceae	Anaerovorax
Flavobacteriaceae	Anaplasma
Francisellaceae	Ancylobacter
Frankiaceae	Anditalea
Fusobacteriaceae	Andreprevotia
Gaiellaceae	Aneurinibacillus
Gallionellaceae	Angustibacter
Gemmatimonadaceae	Anoxybacillus
Geobacteraceae	Aphanizomenon
Geodermatophilaceae	Aphanocapsa
Glycomycetaceae	Aquabacterium
Gordoniaceae	Aquamicrobium
Gracilibacteraceae	Aquaspirillum
Hahellaceae	Aquimarina
Halanaerobiaceae	Aquicola
Haliaceae	Aquitalea
Halobacteroidaceae	Arcanobacterium
Halomonadaceae	Archaeoglobus
Halothiobacillaceae	Archangium
Helicobacteraceae	Arcobacter
Heliobacteriaceae	Arcticibacter
Herpetosiphonaceae	Ardenticatena
Holophagaceae	Arenibacter
Hydrogenophilaceae	Arenimonas
Hydrogenothermaceae	Arhodomonas
Hymenobacteraceae	Aromatoleum
Hyphomicrobiaceae	Arsenicicoccus
Hyphomonadaceae	Arsukibacterium
Idiomarinaceae	Arthrobacter
Ignavibacteriaceae	Arthrospira
Intrasporangiaceae	Asaia
Isosphaeraceae	Asanoa
Jiangellaceae	Asticcacaulis
Jonesiaceae	Atopobium
Kiloniellaceae	Aurantimonas
Kineosporiaceae	Aureimonas
Kofleriaceae	Aureispira
Kordiimonadaceae	Austwickia
Kosmotogaceae	Azoarcus
Ktedonobacteraceae	Azohydromonas
Labilitrichaceae	Azonexus
Lachnospiraceae	Azorhizobium
Lactobacillaceae	Azospira
Legionellaceae	Azospirillum
Lentimicrobiaceae	Azotobacter
Lentisphaeraceae	Azovibrio
Leptospiraceae	Bacillus
Leptotrichiaceae	Bacteriovorax
Leuconostocaceae	Bacteroides
Limnochordaceae	Balneatrix

Listeriaceae	Balneola
Magnetococcaceae	Barnesiella
Marinifilaceae	Barnyardlikevirus
Marinilabiliaceae	Bartonella
Mariprofundaceae	Basilea
Melioribacteraceae	Bdellovibrio
Mesoaciditogaceae	Beggiatoa
Methylacidiphilaceae	Beijerinckia
Methylobacteriaceae	Belliella
Methylococcaceae	Bellilinea
Methylocystaceae	Belnapia
Methylophilaceae	Bergeyella
Methylothermaceae	Bermanella
Microbacteriaceae	Beutenbergia
Microbulbiferaceae	Bhargavaea
Microchaetaceae	Bifidobacterium
Micrococcaceae	Bilophila
Micromonosporaceae	Bizionia
Microthrixaceae	Blastochloris
Moraxellaceae	Blastococcus
Moritellaceae	Blastomonas
Mycobacteriaceae	Blastopirellula
Mycoplasmataceae	Blautia
Myxococcaceae	Bordetella
Nakamurellaceae	Bosea
Nannocystaceae	Brachybacterium
Natranaerobiaceae	Brachymonas
Nautiliaceae	Brachyspira
Neisseriaceae	Bradyrhizobium
Nitriliruptoraceae	Branchiibius
Nitrosomonadaceae	Brenneria
Nitrospinaceae	Brevibacillus
Nitrospiraceae	Brevibacterium
no rank family	Brevundimonas
Nocardiaceae	Brochothrix
Nocardioidaceae	Brucella
Nocardiopsaceae	Bryobacter
Nostocaceae	Burkholderia
Oceanospirillaceae	Butyricoccus
Odoribacteraceae	Butyricimonas
Oleiphilaceae	Butyrvibrio
Opitutaceae	Caballeronia
Oscillochloridaceae	Caedibacter
Oxalobacteraceae	Caenimonas
Paenibacillaceae	Caenispirillum
Parachlamydiaceae	Caldakalibacillus
Parvularculaceae	Caldanaerobacter
Pasteurellaceae	Caldanaerobius
Patulibacteraceae	Caldibacillus
Peptococcaceae	Caldicellulosiruptor
Peptoniphilaceae	Caldicoprobacter
Peptostreptococcaceae	Caldilinea
Persicobacteraceae	Caldimicrobium
Phycisphaeraceae	Caldimonas
Phyllobacteriaceae	Caldisalibacter
Piscirickettsiaceae	Caldisericum

Planctomycetaceae	Caldisphaera
Planococcaceae	Calditerricola
Polyangiaceae	Calditerrivibrio
Porphyromonadaceae	Caldithrix
Porticoccaceae	Caldivirga
Prevotellaceae	Caloramator
Prochloraceae	Caloranaerobacter
Prochlorococcaceae	Calothrix
Prochlorotrichaceae	Caminibacter
Prolixibacteraceae	Campylobacter
Promicromonosporaceae	Candidatus Accumulibacter
Propionibacteriaceae	Candidatus Acetothermum
Pseudoalteromonadaceae	Candidatus Amoebophilus
Pseudomonadaceae	Candidatus Arthromitus
Pseudonocardiaceae	Candidatus Babela
Psychromonadaceae	Candidatus Brocadia
Puniceicoccaceae	Candidatus Caldiarchaeum
Rhizobiaceae	Candidatus Cardinium
Rhodanobacteraceae	Candidatus Chrysopegis
Rhodobacteraceae	Candidatus Cloacimonas
Rhodobiaceae	Candidatus Competibacter
Rhodocyclaceae	Candidatus Contendobacter
Rhodospirillaceae	Candidatus Desulforudis
Rhodothermaceae	Candidatus Entotheonella
Rickettsiaceae	Candidatus Glomeribacter
Rikenellaceae	Candidatus Jettenia
Rivulariaceae	Candidatus Korarchaeum
Roseiflexaceae	Candidatus Koribacter
Ruaniaceae	Candidatus Kryptobacter
Rubritaleaceae	Candidatus Kryptonium
Rubrobacteraceae	Candidatus Kuenenia
Ruminococcaceae	Candidatus Magnetobacterium
Saccharospirillaceae	Candidatus Magnetoglobus
Salinisphaeraceae	Candidatus Magnetomorum
Sandaracinaceae	Candidatus Magnetoovum
Sanguibacteraceae	Candidatus Methanomethylophilus
Saprosiraceae	Candidatus Methanoperedens
Schleiferiaceae	Candidatus Methyloirabilis
Scytonemataceae	Candidatus Methylopumilus
Segniliparaceae	Candidatus Micrarchaeum
Selenomonadaceae	Candidatus Microthrix
Shewanellaceae	Candidatus Nitrosoarchaeum
Simkaniaceae	Candidatus Nitrosocosmicus
Sinobacteraceae	Candidatus Nitrosopelagicus
Sneathiellaceae	Candidatus Nitrosotalea
Solibacteraceae	Candidatus Nitrosotenuis
Solirubrobacteraceae	Candidatus Omnitrophus
Sphaerobacteraceae	Candidatus Paracaedibacter
Sphingobacteriaceae	Candidatus Phaeomarinobacter
Sphingomonadaceae	Candidatus Protochlamydia
Spirochaetaceae	Candidatus Puniceispirillum
Spongiibacteraceae	Candidatus Regiella
Sporichthyaceae	Candidatus Rubidus
Sporolactobacillaceae	Candidatus Saccharimonas
Sporomusaceae	Candidatus Scalindua
Staphylococcaceae	Candidatus Soleaferrea

Streptococcaceae	Candidatus Solibacter
Streptomycetaceae	Candidatus Symbiobacter
Streptosporangiaceae	Candidatus Symbiothrix
Succinivibrionaceae	Candidatus Tenderia
Sulfuricellaceae	Candidatus Xiphinematobacter
Sutterellaceae	Capnocytophaga
Symbiobacteriaceae	Carboxydotherrmus
Synergistaceae	Cardiobacterium
Syntrophaceae	Carnobacterium
Syntrophobacteraceae	Castellaniella
Syntrophomonadaceae	Catabacter
Syntrophorhabdaceae	Catelliglobosipora
Thermaceae	Catenovulum
Thermithiobacillaceae	Catenulispora
Thermoactinomycetaceae	Caulobacter
Thermoanaerobacteraceae	Cecemia
Thermoanaerobacterales Family III. Ince	Cedecea
Thermoanaerobacterales Family IV. Ince	Celeribacter
Thermodesulfobacteriaceae	Cellulomonas
Thermodesulfobiaceae	Cellulophaga
Thermogemmatissporaceae	Cellulosilyticum
Thermomicrobiaceae	Cellulosimicrobium
Thermomonosporaceae	Cellvibrio
Thermonemataceae	Cenarchaeum
Thermotogaceae	Centipeda
Thiotrichaceae	Cephaloticoccus
Trueperaceae	Cesiribacter
Tsukamurellaceae	Cetobacterium
Veillonellaceae	Chamaesiphon
Verrucomicrobia subdivision 3	Che8likevirus
Verrucomicrobia subdivision 6	Che9clikevirus
Verrucomicrobiaceae	Chelativorans
Vibrionaceae	Chelatococcus
Vulgatibacteraceae	Chitinibacter
Waddliaceae	Chitinilyticum
Wenzhouxiangellaceae	Chitinimonas
Williamsiaceae	Chitiniphilus
Xanthobacteraceae	Chitininspirillum
Xanthomonadaceae/315	Chitinophaga
	Chlamydia
	Chloracidobacterium
	Chlorobaculum
	Chlorobium
	Chloroflexus
	Chlorogloeopsis
	Chloroherpeton
	Chlorovirus
	Chondromyces
	Chromobacterium
	Chromohalobacter
	Chroococciopsis
	Chryseobacterium
	Chrysiogenes
	Chryso sporum
	Chthoniobacter
	Chthonomonas

	Citricella
	Citricoccus
	Citrobacter
	Citromicrobium
	Clavibacter
	Cloacibacillus
	Clostridiisalibacter
	Clostridium
	Coccolithovirus
	Cohnella
	Coleofasciculus
	Collimonas
	Collinsella
	Colwellia
	Comamonas
	Commensalibacter
	Conchiformibius
	Conexibacter
	Confluentimicrobium
	Congregibacter
	Coprobacter
	Coprococcus
	Coprothermobacter
	Coraliomargarita
	Corallococcus
	Corynebacterium
	Coxiella
	Crenobacter
	Criblamydia
	Crinalium
	Croceibacter
	Croceicoccus
	Croceitalea
	Crocinitomix
	Crocospaera
	Cronobacter
	Cryobacterium
	Cryocola
	Cryptobacterium
	Cryptosporangium
	Cucumibacter
	Cupriavidus
	Curtobacterium
	Curvibacter
	Cuspidothrix
	Cyanobacterium
	Cyanobium
	Cyanothece
	Cyclobacterium
	Cycloclasticus
	Cylindrospermopsis
	Cylindrospermum
	Cystobacter
	Cytophaga
	Dactylococcopsis
	Dactylosporangium

	Dasania
	Dechloromonas
	Deefgea
	Deferrisoma
	Defluviimonas
	Defluviitalea
	Dehalobacter
	Dehalococcoides
	Dehalogenimonas
	Deinococcus
	Delftia
	Demequina
	Demetria
	Denitrobacterium
	Denitrovibrio
	Dermacoccus
	Dermatophilus
	Derxia
	Desmospora
	Desulfarculus
	Desulfatibacillum
	Desulfatiglans
	Desulfatirhabdium
	Desulfatitalea
	Desulfitibacter
	Desulfitobacterium
	Desulfobacca
	Desulfobacter
	Desulfobacterium
	Desulfobacula
	Desulfobulbus
	Desulfocapsa
	Desulfocarbo
	Desulfococcus
	Desulfocurvus
	Desulfofustis
	Desulfohalobium
	Desulfomicrobium
	Desulfomonile
	Desulfonatronospira
	Desulfonatronovibrio
	Desulfonatronum
	Desulfonauticus
	Desulforegula
	Desulfosarcina
	Desulfospira
	Desulfosporosinus
	Desulfotignum
	Desulfotomaculum
	Desulfovermiculus
	Desulfovibrio
	Desulfovirgula
	Desulfurella
	Desulfurispirillum
	Desulfurispora
	Desulfurivibrio

	Desulfurobacterium
	Desulfuromonas
	Dethiobacter
	Dethiosulfatarculus
	Dethiosulfovibrio
	Devosia
	Devriesea
	Dialister
	Diaphorobacter
	Dickeya
	Dictyoglomus
	Dietzia
	Dinoroseobacter
	Diplosphaera
	Dokdonella
	Dokdonia
	Dolichospermum
	Domibacillus
	Dongia
	Draconibacterium
	Duganella
	Dyadobacter
	Dyella
	Dysgonomonas
	Echinicola
	Ectothiorhodospira
	Edaphobacter
	Edwardsiella
	Effusibacillus
	Eggerthella
	Eikenella
	Elioraea
	Elizabethkingia
	Elstera
	Elusimicrobium
	Empedobacter
	Emticicia
	Endomicrobium
	Endozoicomonas
	Enhydrobacter
	Enhygromyxa
	Ensifer
	Enterobacter
	Enterococcus
	Enterorhabdus
	Enterovibrio
	Epilithonimonas
	Erwinia
	Erysipelothrix
	Erythrobacter
	Escherichia
	Estrella
	Eubacterium
	Eudoraea
	Euryhalocaulis
	Ewingella

	Exiguobacterium
	Faecalibacterium
	Faecalicoccus
	Faecalitalea
	Fermentimonas
	Ferrimicrobium
	Ferrimonas
	Ferriphaselus
	Ferroglobus
	Ferroplasma
	Ferrovum
	Fervidicella
	Fervidicola
	Fervidobacterium
	Fibrella
	Fibrisoma
	Fictibacillus
	Filomicrobium
	Fimbriimonas
	Fischerella
	Flagellimonas
	Flammeovirga
	Flaviflexus
	Flaviumibacter
	Flaviramulus
	Flavisolibacter
	Flavobacterium
	Flectobacillus
	Flexibacter
	Flexilinea
	Flexistipes
	Flexithrix
	Fluoribacter
	Fluviicola
	Fodinicurvata
	Formosa
	Francisella
	Franconibacter
	Frankia
	Frateuria
	Fretibacterium
	Frigoribacterium
	Frondihabitans
	Fulvimarina
	Fulvivirga
	Fusobacterium
	Gaiella
	Galbibacter
	Gallaecimonas
	Gallibacterium
	Gallionella
	Gardnerella
	Gayadomonas
	Geitlerinema
	Gelidibacter
	Geminicoccus

	Geminocystis
	Gemmata
	Gemmatimonas
	Gemmatirosa
	Gemmobacter
	Geoalkalibacter
	Geobacillus
	Geobacter
	Geodermatophilus
	Geofilum
	Geoglobus
	Geopsychrobacter
	Georgenia
	Geothrix
	Geovibrio
	Gillisia
	Gilvimarinus
	Gimesia
	Glaciecocola
	Glaciibacter
	Gloeobacter
	Gloeocapsa
	Gluconacetobacter
	Gluconobacter
	Glutamicibacter
	Glycomyces
	Gordonia
	Gorillibacterium
	Gottschalkia
	Gracilibacillus
	Gracilibacter
	Gracilimonas
	Gramella
	Granulibacter
	Granulicella
	Granulicoccus
	Grimontia
	Gryllotalpicola
	Gulbenkiania
	Gulosibacter
	Gynuella
	Haematobacter
	Haematospirillum
	Haemophilus
	Hafnia
	Hahella
	Haladaptatus
	Halalkalibacillus
	Halalkalicoccus
	Halanaeroarchaeum
	Halanaerobium
	Halapricum
	Halarchaeum
	Haliangium
	Halica
	Halioglobus

	Haliscomenobacter
	Haloarcula
	Halobacillus
	Halobacterium
	Halobacteroides
	Halococcus
	Halocynthiibacter
	Haloferax
	Haloferula
	Halogeometricum
	Haloglycomyces
	Halogranum
	Halomicrobium
	Halomonas
	Halonatronum
	Halonotius
	Halopiger
	Haloplanus
	Haloplasma
	Haloquadratum
	Halorhabdus
	Halorhodospira
	Halorubrum
	Halosimplex
	Halotalea
	Haloterrigena
	Halothece
	Halothermothrix
	Halothiobacillus
	Halovivax
	Hamadaea
	Hapalosiphon
	Hassallia
	Helicobacter
	Heliobacillus
	Heliobacterium
	Hellea
	Henriciella
	Herbaspirillum
	Herbiconiux
	Herbidospora
	Herbinix
	Herminiimonas
	Herpetosiphon
	Hippea
	Hirschia
	Hoeflea
	Holdemania
	Holophaga
	Humibacter
	Hyalangium
	Hydrocarboniphaga
	Hydrogenibacillus
	Hydrogenivirga
	Hydrogenobacter
	Hydrogenobaculum

	Hydrogenophaga
	Hylemonella
	Hymenobacter
	Hyphomicrobium
	Hyphomonas
	I3likevirus
	Ideonella
	Idiomarina
	Ignavibacterium
	Ignicoccus
	Ilumatobacter
	Imtechella
	Indibacter
	Inquilinus
	Intestinimonas
	Intrasporangium
	Isopterocola
	Isosphaera
	Janibacter
	Jannaschia
	Janthinobacterium
	Jejuia
	Jeotgalibaca
	Jeotgalibacillus
	Jeotgalicoccus
	Jiangella
	Jonesia
	Joostella
	Kaistia
	Kamptonema
	Kangiella
	Kerstesia
	Ketogulonicigenium
	Kibdelosporangium
	Kiloniella
	Kineococcus
	Kineosphaera
	Kingella
	Kitasatospora
	Klebsiella
	Kluyvera
	Knoellia
	Kocuria
	Komagataeibacter
	Kordia
	Kordiimonas
	Kosmotoga
	Kouleothrix
	Kribbella
	Ktedonobacter
	Kushneria
	Kutzneria
	Kyrpidia
	L5likevirus
	Labilithrix
	Labrenzia

	Lachnoclostridium
	Lacimicrobium
	Lacinutrix
	Lactobacillus
	Lactococcus
	Lamprocystis
	Lampropedia
	Laribacter
	Lautropia
	Leadbetterella
	Lebetimonas
	Lechevalieria
	Leeia
	Leeuwenhoekella
	Legionella
	Leifsonia
	Leisingera
	Leminorella
	Lentibacillus
	Lentimicrobium
	Lentisphaera
	Lentzea
	Leptolinea
	Leptolyngbya
	Leptonema
	Leptospira
	Leptospirillum
	Leptothrix
	Leptotrichia
	Leucobacter
	Leucothrix
	Levilinea
	Lewinella
	Limnobacter
	Limnochorda
	Limnohabitans
	Limnoraphis
	Listeria
	Litoreibacter
	Lokiarchaeum
	Loktanella
	Longilinea
	Longispora
	Luminiphilus
	Lunatimonas
	Luteibacter
	Luteimonas
	Luteipulveratus
	Lutibacter
	Lutibaculum
	Lymphocryptovirus
	Lyngbya
	Lysinibacillus
	Lysinimicrobium
	Lysobacter
	Magnetococcus

	Magnetospira
	Magnetospirillum
	Mahella
	Mangrovimonas
	Mannheimia
	Maribacter
	Maribius
	Maricaulis
	Marichromatium
	Marinifilum
	Marinilabilia
	Marinimicrobium
	Mariniradius
	Marinithermus
	Marinitoga
	Marinobacter
	Marinobacterium
	Marinococcus
	Marinomonas
	Marinospirillum
	Marinovum
	Mariprofundus
	Maritalea
	Maritimibacter
	Marivirga
	Marmoricola
	Martellella
	Massilia
	Mastigocladopsis
	Mastigocladus
	Mastigocoleus
	Megamonas
	Meganema
	Megasphaera
	Meiothermus
	Melioribacter
	Mesoaciditoga
	Mesoflavibacter
	Mesonia
	Mesorhizobium
	Mesotoga
	Metallosphaera
	Methanobacterium
	Methanobrevibacter
	Methanocalculus
	Methanocaldococcus
	Methanocella
	Methanococcoides
	Methanococcus
	Methanocorpusculum
	Methanoculleus
	Methanofollis
	Methanohalobium
	Methanolacinia
	Methanolinea
	Methanolobus

	Methanomassiliicoccus
	Methanomethylovorans
	Methanoplanus
	Methanoregula
	Methanosaeta
	Methanosalsum
	Methanosarcina
	Methanosphaera
	Methanosphaerula
	Methanospirillum
	Methanothermobacter
	Methermicoccus
	Methylacidiphilum
	Methylibium
	Methylobacillus
	Methylobacter
	Methylobacterium
	Methylocaldum
	Methylocapsa
	Methyloceanibacter
	Methylocella
	Methylococcus
	Methylocystis
	Methyloferula
	Methylogaea
	Methyloglobulus
	Methylohalobius
	Methylomarinum
	Methylomicrobium
	Methylomonas
	Methylophaga
	Methylophilus
	Methylopila
	Methylosarcina
	Methylosinus
	Methylotenera
	Methyloversatilis
	Methylovorus
	Methylovulum
	Micavibrio
	Microbacterium
	Microbispora
	Microbulbifer
	Microcella
	Microchaete
	Micrococcus
	Microcoleus
	Microcystis
	Microlunatus
	Micromonospora
	Microscilla
	Microterricola
	Microtetrastroma
	Microvirga
	Microvirgula
	Mimivirus

	Mitsuokella
	Mizugakiibacter
	Mobilicoccus
	Modestobacter
	Moellerella
	Mogibacterium
	Moorea
	Moorella
	Moraxella
	Morganella
	Moritella
	Mucilaginibacter
	Mucinivorans
	Mucispirillum
	Mumia
	Muricauda
	Mycetocola
	Mycobacterium
	Mycoplasma
	Myroides
	Myxococcus
	Myxosarcina
	Nafulsella
	Nakamurella
	Nannocystis
	Natranaerobius
	Natrialba
	Natrinema
	Natronorubrum
	Nautella
	Negativicoccus
	Neisseria
	Neochlamydia
	Neorhizobium
	Neosynechococcus
	Neptunomonas
	Nesiotobacter
	Nesterenkonia
	Nevskia
	Niabella
	Niastella
	Nisaea
	Nitratifractor
	Nitratireductor
	Nitratiruptor
	Nitriliruptor
	Nitrincola
	Nitritalea
	Nitrobacter
	Nitrococcus
	Nitrolancea
	Nitrosococcus
	Nitrosomonas
	Nitrosopumilus
	Nitrososphaera
	Nitrosospira

	Nitrospina
	Nitrospira
	Nitrospirillum
	Niveispirillum
	no rank genus
	Nocardia
	Nocardioides
	Nocardiopsis
	Nodosilinea
	Nodularia
	Nonlabens
	Nonomuraea
	Nostoc
	Noviherbaspirillum
	Novispirillum
	Novosphingobium
	Oblitimonas
	Oceanibaculum
	Oceanibulbus
	Oceanicaulis
	Oceanicola
	Oceanimonas
	Oceaniovalibus
	Oceanithermus
	Oceanobacillus
	Oceanobacter
	Oceanospirillum
	Ochrobactrum
	Octadecabacter
	Odoribacter
	Oerskovia
	Oleiagrimonas
	Oleiphilus
	Oleispira
	Oligella
	Oligotropha
	Olivibacter
	Olleya
	Olsenella
	Omegalikevirus
	Opitutus
	Orenia
	Ornatilinea
	Ornithinibacillus
	Ornithinimicrobium
	Ornithobacterium
	Oscillatoria
	Oscillochloris
	Ottowia
	Owenweeksia
	Oxalobacter
	Oxobacter
	Paenarthrobacter
	Paenibacillus
	Paeniclostridium
	Paeniglutamicibacter

	Paenisporosarcina
	Palaeococcus
	Paludibacter
	Paludibacterium
	Pandoraea
	Pannonibacter
	Pantoea
	Parabacteroides
	Paraburkholderia
	Parachlamydia
	Paracoccus
	Paraglaeicola
	Paramesorhizobium
	Pararhodospirillum
	Parasutterella
	Parvibaculum
	Parvularcula
	Pasteurella
	Patulibacter
	Paucibacter
	Paucisalibacillus
	Pbiunalikevirus
	Pectobacterium
	Pediococcus
	Pedobacter
	Pedosphaera
	Pelagibaca
	Pelagibacterium
	Pelobacter
	Pelodictyon
	Pelomonas
	Pelosinus
	Pelotomaculum
	Peptoclostridium
	Peptoniphilus
	Perlucidibaca
	Persephonella
	Persicobacter
	Petrotoga
	Phaeobacter
	Phaeodactylibacter
	Phaeospirillum
	Phascolarctobacterium
	Phenylobacterium
	Phic3unalikevirus
	Phocaeicola
	Phormidesmis
	Phormidium
	Photobacterium
	Photorhabdus
	Phycoccus
	Phycisphaera
	Phyllobacterium
	Picrophilus
	Pimelobacter
	Pirellula

	Planctomyces
	Planctopirus
	Planktomarina
	Planktothricoides
	Planktothrix
	Planobispora
	Planococcus
	Planomicrobium
	Planomonospora
	Plantibacter
	Pleomorphomonas
	Plesiocystis
	Plesiomonas
	Pleurocapsa
	Polaribacter
	Polaromonas
	Polycyclovorans
	Polymorphum
	Polynucleobacter
	Pontibacillus
	Pontibacter
	Ponticaulis
	Ponticoccus
	Porphyrobacter
	Porphyromonas
	Porticoccus
	Pragia
	Prauserella
	Prevotella
	Prochlorococcus
	Prochloron
	Prochlorothrix
	Prolixibacter
	Promicromonospora
	Propionibacterium
	Propioniceella
	Propionimicrobium
	Propionispira
	Propionispora
	Prosthecochloris
	Prosthecomicrobium
	Proteiniphilum
	Proteocatella
	Proteus
	Providencia
	Pseudacidovorax
	Pseudaminobacter
	Pseudanabaena
	Pseudarthrobacter
	Pseudoalteromonas
	Pseudobacteroides
	Pseudoclavibacter
	Pseudodonghicola
	Pseudoduganella
	Pseudoflavonifactor
	Pseudogulbenkiana

	Pseudohalica
	Pseudohongiella
	Pseudolabrys
	Pseudomonas
	Pseudonocardia
	Pseudoceanicola
	Pseudopedobacter
	Pseudorhodobacter
	Pseudorhodoferax
	Pseudothermotoga
	Pseudovibrio
	Pseudoxanthomonas
	Psychrilyobacter
	Psychrobacter
	Psychroflexus
	Psychromonas
	Psychroserpens
	Puniceibacterium
	Pusillimonas
	Pyramidobacter
	Pyrinomonas
	Pyrobaculum
	Pyrococcus
	Pyrolobus
	Rahnella
	Ralstonia
	Ramlibacter
	Raoultella
	Rathayibacter
	Reinekea
	Reyranella
	Rhadinovirus
	Rheinheimera
	Rhizobacter
	Rhizobium
	Rhizomicrobium
	Rhodanobacter
	Rhodobacter
	Rhodococcus
	Rhodoferax
	Rhodomicrobium
	Rhodonellum
	Rhodopirellula
	Rhodoplanes
	Rhodopseudomonas
	Rhodospirillum
	Rhodothermus
	Rhodovibrio
	Rhodovulum
	Richelia
	Rickettsia
	Riemerella
	Risunbinella
	Rivularia
	Robiginitalea
	Robinsoniella

	Roseateles
	Roseburia
	Roseibacterium
	Roseibium
	Roseiflexus
	Roseivirga
	Roseivivax
	Roseobacter
	Roseomonas
	Roseovarius
	Rouxiella
	Ruania
	Rubellimicrobium
	Rubidibacter
	Rubinisphaera
	Rubritalea
	Rubritepida
	Rubrivivax
	Rubroacter
	Rudaea
	Rudanella
	Ruegeria
	Rufibacter
	Ruminiclostridium
	Ruminobacter
	Ruminococcus
	Rummeliibacillus
	Runella
	Saccharibacillus
	Saccharibacter
	Saccharicrinis
	Saccharomonospora
	Saccharophagus
	Saccharopolyspora
	Saccharosporillum
	Saccharothrix
	Sagittula
	Salegentibacter
	Salimicrobium
	Salinarchaeum
	Salinarimonas
	Salinibacter
	Salinicoccus
	Salinimicrobium
	Salinimonas
	Salinisphaera
	Salinispira
	Salinisporea
	Salinivibrio
	Salipiger
	Salisaeta
	Salmonella
	Sandaracinus
	Sandarakinorhabdus
	Sanguibacter
	Sanguibacteroides

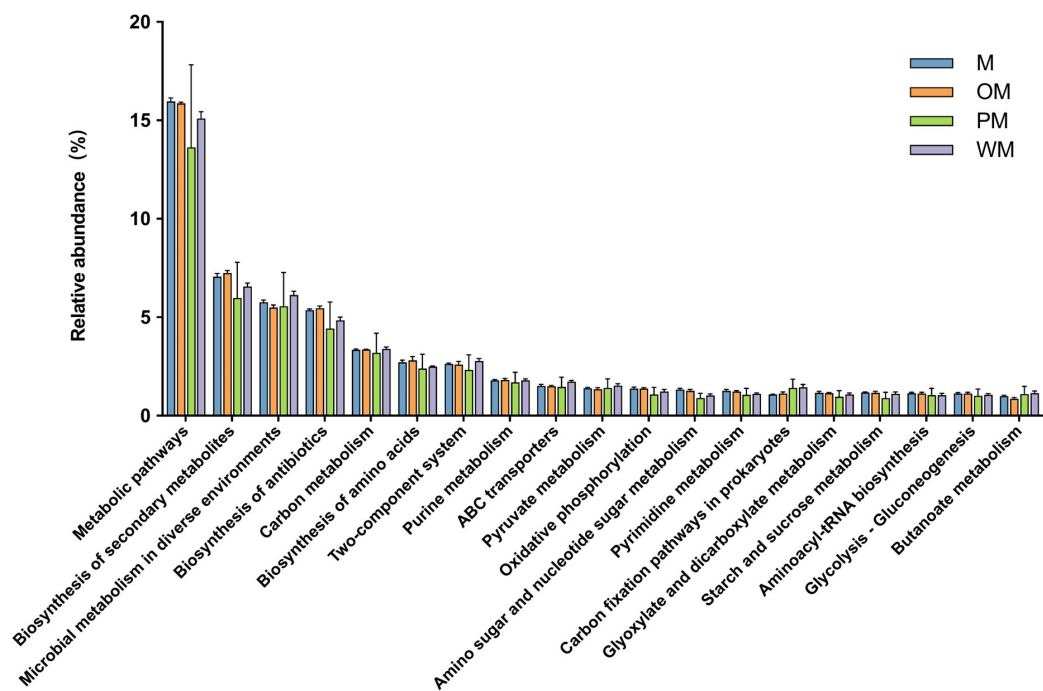
	Saprospira
	Schizot4likevirus
	Schleiferia
	Schlesneria
	Sciscionella
	Scytonema
	Sedimentibacter
	Sedimenticola
	Sediminibacter
	Sediminibacterium
	Sediminimonas
	Segetibacter
	Segniliparus
	Selenomonas
	Serinicoccus
	Serpens
	Serratia
	Shewanella
	Shigella
	Shimazuella
	Shimia
	Shimwellia
	Shinella
	Shuttleworthia
	Siansivirga
	Sideroxydans
	Silanimonas
	Silvibacterium
	Silvimonas
	Simiduia
	Simkania
	Simplicispira
	Singulisphaera
	Sinomonas
	Sinorhizobium
	Skermanella
	Slackia
	Smaragdicoccus
	Smithella
	Sneathiella
	Snodgrassella
	Sodalis
	Solibacillus
	Solimonas
	Solirubrobacter
	Solitalea
	Sorangium
	Sphaerobacter
	Sphaerochaeta
	Sphaerotilus
	Sphingobacterium
	Sphingobium
	Sphingomonas
	Sphingopyxis
	Sphingorhabdus
	Sphingosinicella

	Spiribacter
	Spirillospora
	Spirochaeta
	Spirosoma
	Spirulina
	Spongiibacter
	Sporichthya
	Sporocytophaga
	Sporolactobacillus
	Sporomusa
	Sporosarcina
	Stackebrandtia
	Stanieria
	Staphylococcus
	Staphylothermus
	Stappia
	Starkeya
	Stenotrophomonas
	Stenoxybacter
	Steroidobacter
	Sterolibacterium
	Stigmatella
	Streptacidiphilus
	Streptoalloteichus
	Streptococcus
	Streptomonospora
	Streptomyces
	Streptosporangium
	Subdoligranulum
	Succinatimonas
	Sulfitobacter
	Sulfobacillus
	Sulfolobus
	Sulfuricella
	Sulfuricurvum
	Sulfurihydrogenibium
	Sulfuritalea
	Sulfurospirillum
	Sulfurovum
	Sunxiuqinia
	Sutterella
	Symbiobacterium
	Synechococcus
	Synechocystis
	Synergistes
	Syntrophaceticus
	Syntrophobacter
	Syntrophobotulus
	Syntrophomonas
	Syntrophorhabdus
	Syntrophothermus
	Syntrophus
	T4likevirus
	Tamlana
	Tannerella
	Tanticharoenia

	Tardiphaga
	Tateyamaria
	Tatlockia
	Tatumella
	Taylorella
	Tenacibaculum
	Tepidanaerobacter
	Tepidibacillus
	Tepidicaulis
	Tepidimonas
	Tepidiphilus
	Terasakiella
	Teredinibacter
	Terrabacter
	Terracidiphilus
	Terracoccus
	Terribacillus
	Terriglobus
	Terrimicrobium
	Terrimonas
	Tessaracoccus
	Tetrasphaera
	Thalassobacillus
	Thalassobacter
	Thalassobaculum
	Thalassobius
	Thalassolituus
	Thalassomonas
	Thalassospira
	Thalassotalea
	Thauera
	Thermacetogenium
	Thermaerobacter
	Thermanaerothrix
	Thermanaerovibrio
	Thermicanus
	Thermincola
	Thermithiobacillus
	Thermoactinomyces
	Thermoanaerobacter
	Thermoanaerobacterium
	Thermoanaerobaculum
	Thermobacillus
	Thermobaculum
	Thermobifida
	Thermobispora
	Thermobrachium
	Thermococcus
	Thermocrinis
	Thermocrispum
	Thermodesulfatator
	Thermodesulfobacterium
	Thermodesulfobium
	Thermodesulfovibrio
	Thermofilum
	Thermogemmatispora

	Thermomicrobium
	Thermomonas
	Thermomonospora
	Thermonema
	Thermopetrobacter
	Thermophagus
	Thermoplasma
	Thermoproteus
	Thermorudis
	Thermosediminibacter
	Thermosinus
	Thermosipho
	Thermosphaera
	Thermosulfidibacter
	Thermosynechococcus
	Thermotoga
	Thermovenabulum
	Thermovibrio
	Thermovirga
	Thermus
	Thioalkalimicrobium
	Thioalkalivibrio
	Thiobacillus
	Thiocapsa
	Thioclava
	Thiocystis
	Thioflavicoccus
	Thiohalocapsa
	Thiohalorhabdus
	Thiolapillus
	Thiomargarita
	Thiomicrospira
	Thiomonas
	Thioploca
	Thiorhodococcus
	Thiorhodospira
	Thiorhodovibrio
	Thiothrix
	Thiovulum
	Tistrella
	Tolumonas
	Tolypothrix
	Tomitella
	Treponema
	Trichodesmium
	Tropicibacter
	Truepera
	Tsukamurella
	Tuberibacillus
	Tumebacillus
	Turicibacter
	Turneriella
	Tyzzera
	Uliginosibacterium
	Ureibacillus
	Varicellovirus

	Variovorax
	Veillonella
	Verminephrobacter
	Vermiphilus
	Verrucomicrobium
	Verrucosispora
	Vibrio
	Virgibacillus
	Vitellibacter
	Vitreoscilla
	Vogesella
	Vulcanisaeta
	Vulgatibacter
	Waddlia
	Weissella
	Wenxinia
	Wenzhouxiangella
	Williamsia
	Winogradskyella
	Wolbachia
	Wolinella
	Woodsholea
	Xanthobacter
	Xanthomarina
	Xanthomonas
	Xenococcus
	Xenophilus
	Xenorhabdus
	Xp10likevirus
	Xylanimonas
	Xylella
	Xylophilus
	Yaniella
	Yersinia
	Yonghaparkia
	Youngiibacter
	Yualikevirus
	Zavarzinella
	Zhongshania
	Zhouia
	Zobellia
	Zooshikella
	Zunongwangia
	Zymbacter
	Zymomonas



Appendix E Top 20 metabolic pathways of soil prokaryotes annotated using the KEGG database under four cropping systems. M, Maize continuous cropping; WM, wheat-maize rotation; PM, potato-maize rotation; OM, oil seed-maize rotation cropping system.