

**Table S1** Summary of environmental and microbial variables

	N	Nm	Nf	C	Cm	Cf	S	Sm	Sf
<i>Soil physical-chemical variable</i>									
pH	6.2±0.2c <sup>b</sup>	6.1±0c	5.7±0.2d	7.9±0.1ab	8.1±0.1a	7.7±0.3b	5.3±0.1e	5±0.1ef	4.9±0.1f
SOM <sup>a</sup> (g/kg)	46.4±0.8c	51.4±1.2b	54.5±1.3a	8.7±0.4ef	8.3±0.5f	9.7±1.3def	9.8±0.1de	9.6±0.4def	10.7±0.3d
WHC (%)	48.9±0b	71.2±6.4a	68.9±4.8a	25.3±0d	26.5±1.2d	27.3±5.2d	27.9±0d	38.8±4.5c	41.7±2.5c
BD (g/cm <sup>3</sup> )	1.1±0c	0.9±0d	0.9±0.1d	1.5±0a	1.4±0ab	1.4±0.1ab	1.4±0b	1.1±0.1c	1.1±0c
Sp (%)	56.4±0b	65.4±0.9a	64.4±2.4a	45±0cd	47.6±1.6c	46.5±3.5cd	43.1±0d	52.6±3.5b	54.1±3.8b
Ec (µs/cm)	22.7±3.1e	52.0±5.9b	74.0±21a	33.1±6.6de	66.6±8.8a	51.5±6bc	26.7±1.8de	37.6±1.1cd	80.3±2.8a
CEC (cmol/kg)	34.3±1.3a	34.5±0.7a	31.0±1b	11.8±0.5c	34.4±0.5a	11.8±0.6c	12.3±0.4c	12.0±0.4c	7.9±0.3d
TN (g/kg)	1.8±0.3b	2.2±0.1a	2.3±0.2a	0.6±0c	0.5±0.1c	0.8±0.2c	0.6±0.1c	0.8±0.4c	0.7±0.1c
TP (g/kg)	0.8±0ab	0.8±0ab	0.9±0a	0.7±0.1bc	0.6±0de	0.7±0cd	0.4±0f	0.4±0f	0.5±0ef
TK (g/kg)	18.7±0.1ab	18.4±0.5ab	18.5±0.2ab	20.6±3.8a	17.5±0.4b	17.6±0.5b	9.7±0.5c	9.7±0.4c	9.3±0.4c
AP (mg/kg)	39.6±3.8a	26.8±5.6b	37.2±4.1a	7.3±0.3d	3.5±0.4d	7.8±1.2d	17.3±0.7c	17.3±2.6c	29.7±3.9b
AK (mg/kg)	201.7±40.2a	139.2±5.8b	112.5±6.6c	99.2±7.6cd	73.3±1.4e	84.2±5.8de	109.2±1.4c	110±5c	110.8±3.8c
NH <sub>4</sub> -N (mg/kg)	0.6±0.4b	0.6±0.1b	1.6±0.8a	0.6±0.3b	0.8±0.1b	0.9±0.2b	1.8±0.5a	1.6±0.1a	1.7±0.3a
NO <sub>3</sub> -N (mg/kg)	13.3±5.9ab	10.6±6.2b	23.3±18.5a	4.4±1.6b	4.2±0.5b	6.8±1.6b	5.3±0.3b	5.2±0.4b	6.6±0.3b
<i>Plant variable</i>									
seed weight (kg/ha)		2246±1464d	8652±2046a		5340±225bc	7274±854ab		NA <sup>c</sup>	3955±672cd
above ground biomass (kg/ha)		4822±284cd	9523±3035a		5232±964bc	7477±1067ab		2440±103d	6349±343bc
TN_Seed (g/kg)		10.7±1.7bc	13.2±1.2a		9.4±1.3c	11.7±0.7ab		NA	9.1±0.5c
TP_Seed (g/kg)		3.7±0.8a	4.4±0.4a		1.8±0.7b	1.9±0.4b		NA	2±0.2b
TK_Seed (g/kg)		4.5±0.6a	5.4±0.6a		3.3±0.2b	3.5±0.4b		NA	3.4±0.2b
TOC_Seed (g/kg)		418.1±3.9ab	417.8±12.8a		440.9±5.9a	433.8±24.5a		NA	391.3±9.2b

TN_Stem (g/kg)		4.7±1.3b	6.8±1.4a		6.2±1a	6.8±0.7a		3.2±0.8c	3.7±0.5bc	
TP_Stem (g/kg)		2.8±0.5a	2±0.8b		0.6±0.2c	0.8±0.2c		1.8±0.2b	0.4±0.1c	
TK_Stem (g/kg)		5.2±3.1b	11.6±3.3a		10.6±1.9a	14.3±2.3a		13.2±0.6a	11.6±4.9a	
TOC_Stem (g/kg)		372.9±2c	388.3±7.9bc		421.6±7a	420.7±8.2a		382.7±5.7c	403.8±15.2b	
<i>Climate parameter</i>										
Annual T (°C)	2.1c	2.1c	2.1c		13.5b	13.5±0b	13.5b	18.1a	18.1a	18.1a
Annual R (mm)	496.2c	496.2c	496.2c		832.9b	832.9b	832.9b	1495a	1495a	1495a
Relative humidity (%)	64.7b	64.7b	64.7b		72.0a	72.0a	72.0a	61.6c	61.6c	61.6c
<i>Microbial biomass (nmol/g DW)</i>										
Bacterial	12±1a	11.4±1.7a	9.1±0.9b		2.1±0.5e	4.1±1.7cd	3.1±0.2de	3.4±0.4de	3.8±0.5cde	5.4±0.5c
Fungal	3.3±1ab	3.5±1.2a	2±0.3c		0.7±0.1d	2.2±0.9bc	1.6±0.2cd	1.8±0.5cd	1.5±0.2cd	2.5±0.6abc
Total	42.2±8.6a	43.1±12.7a	35.4±4.1ab		9.6±0.6e	18.1±4.4cde	16.4±1.3de	21.3±4.8cd	16.6±0.3de	28.6±7.1bc
Fungal/bacterial	0.3±0.1cd	0.3±0.1cd	0.2±0d		0.4±0.1bcd	0.5±0.1ab	0.5±0.1ab	0.5±0.2a	0.4±0.1abc	0.5±0.1abc
<i>Soil functional process</i>										
Nitrification (mg NO <sub>3</sub> -N/kg DW)	37.5±9bc	29.9±0.6c	36.4±6.3bc		41.9±11.1ab	43.4±3.4ab	47.9±4.9a	12±2.1d	12.3±1.4d	15.4±2.3d
CO <sub>2</sub> efflux (umol/m <sup>2</sup> /s)	1063.5a	1050.2±5.7a	1061.1±4.5a		512.4±85.8c	722±92.3b	435.5±50.5cd	322.8±144.1d	500.9±101.4c	527.5±21.1c

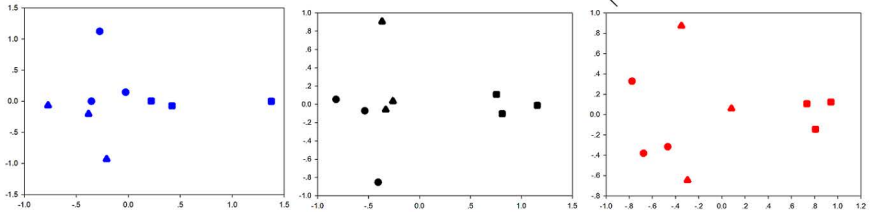
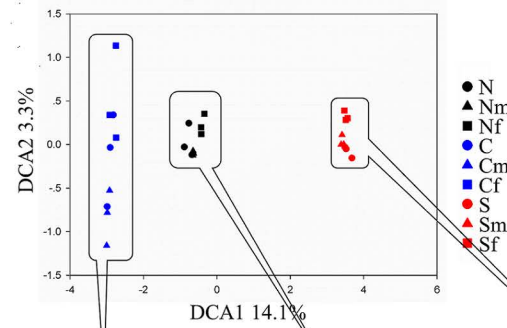
<sup>a</sup>Abbreviation: SOM – soil organic matter, WHC – water hold capacity, BD – soil bulk density, Sp – soil porosity, Ec – electrical conductivity, CEC – cation exchange capacity, TN – total nitrogen, TP – total phosphorus, TK – total potassium, AP – available phosphorus, AK - available potassium, TOC – total organic matter, Annual T – annual average temperature, Annual R – annual rainfall.

Values were MEAN ± SD. SD stands for standard deviation

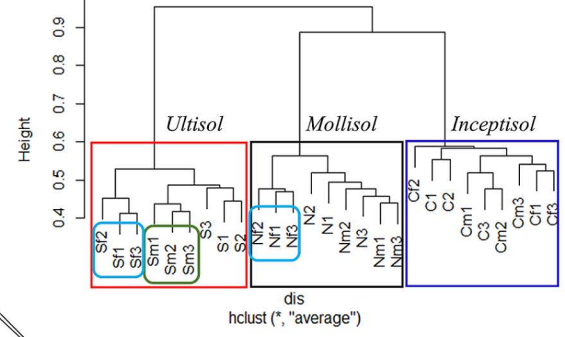
<sup>b</sup>Letters behind each value indicate significance of differences. Treatments with any same letters are insignificantly different ( $P > 0.05$ ) as determined by one-way ANOVA followed by the LSD test in SAS version 6.1.

<sup>c</sup>NA: data not available.

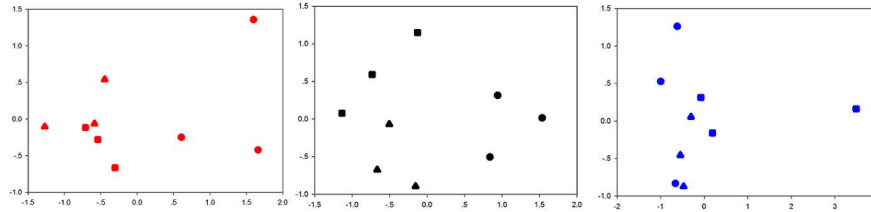
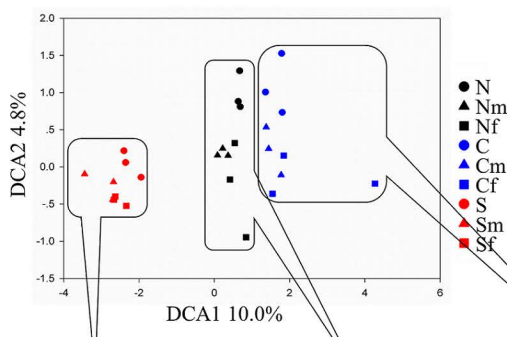
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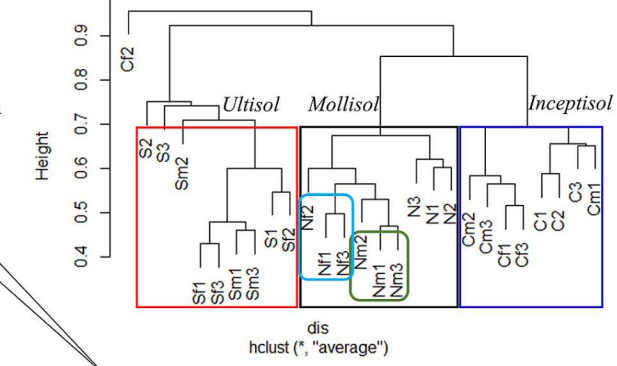
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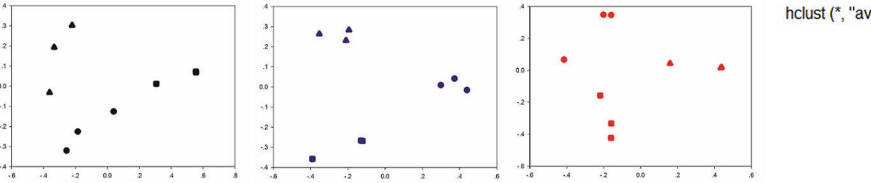
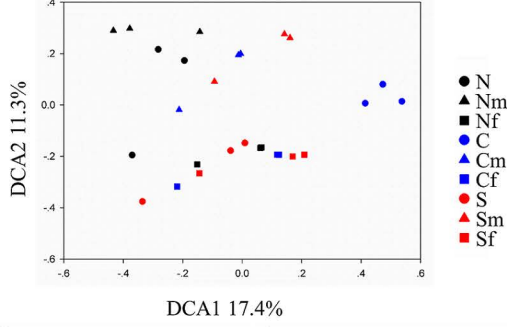
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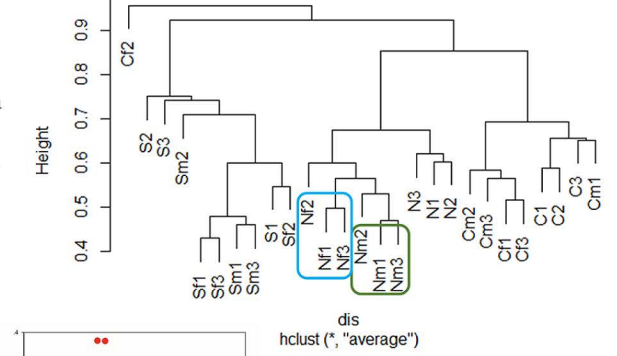
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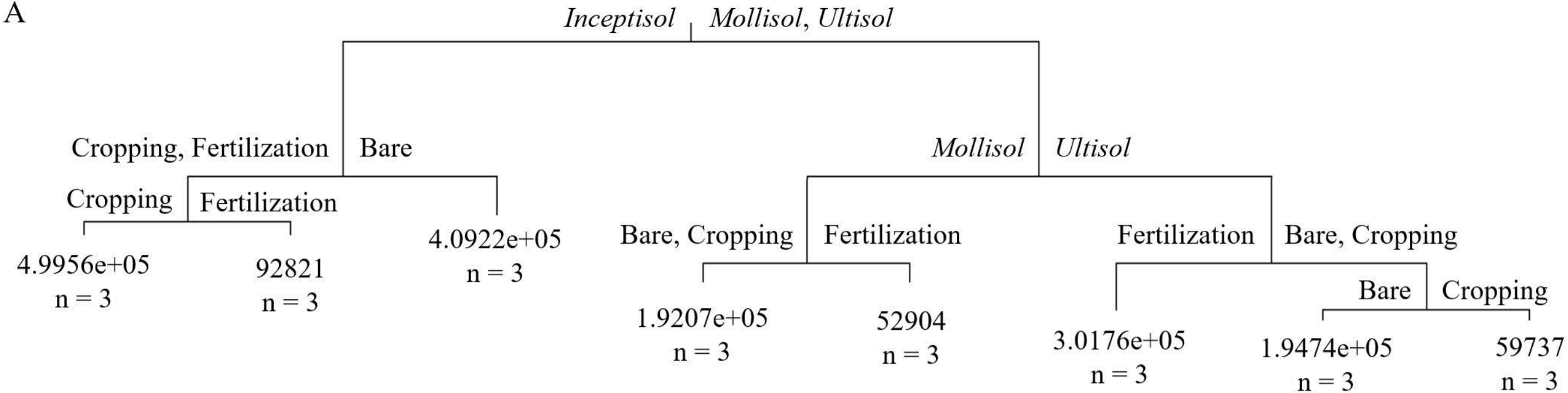
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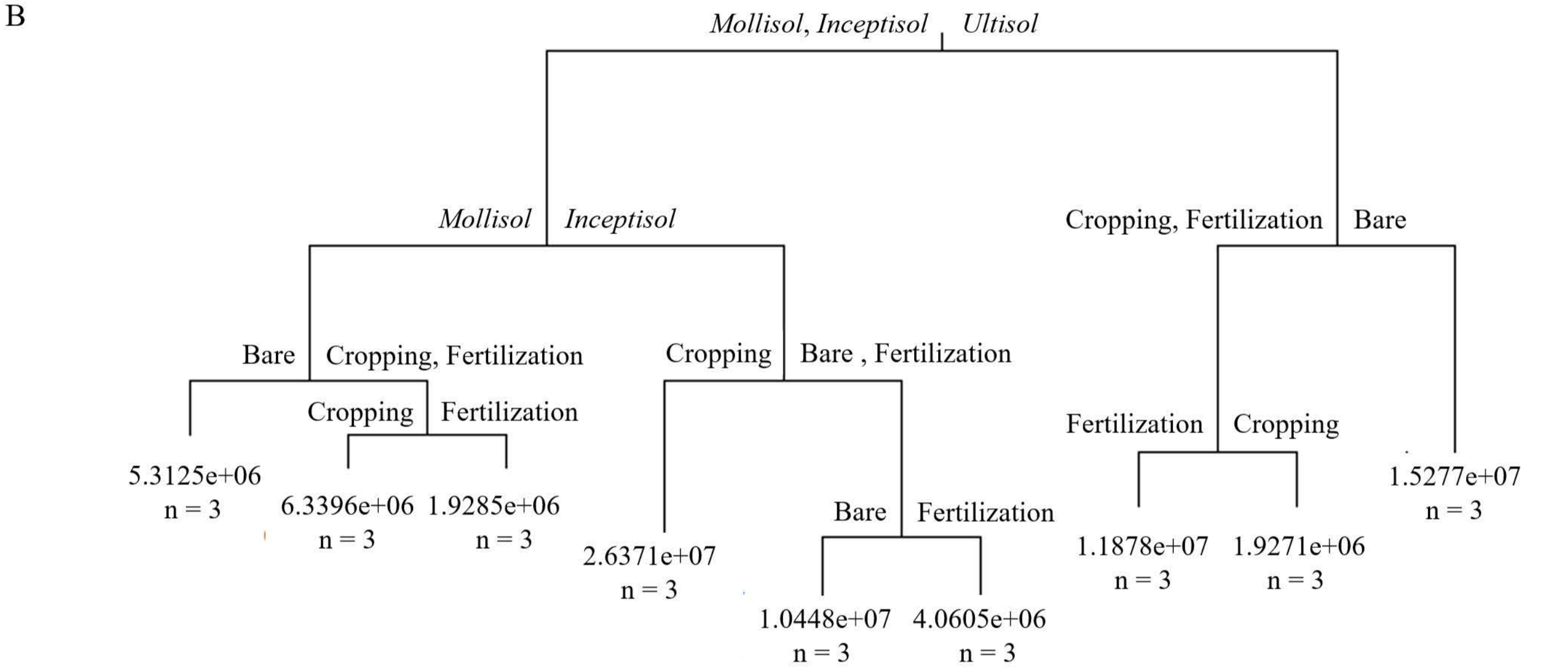
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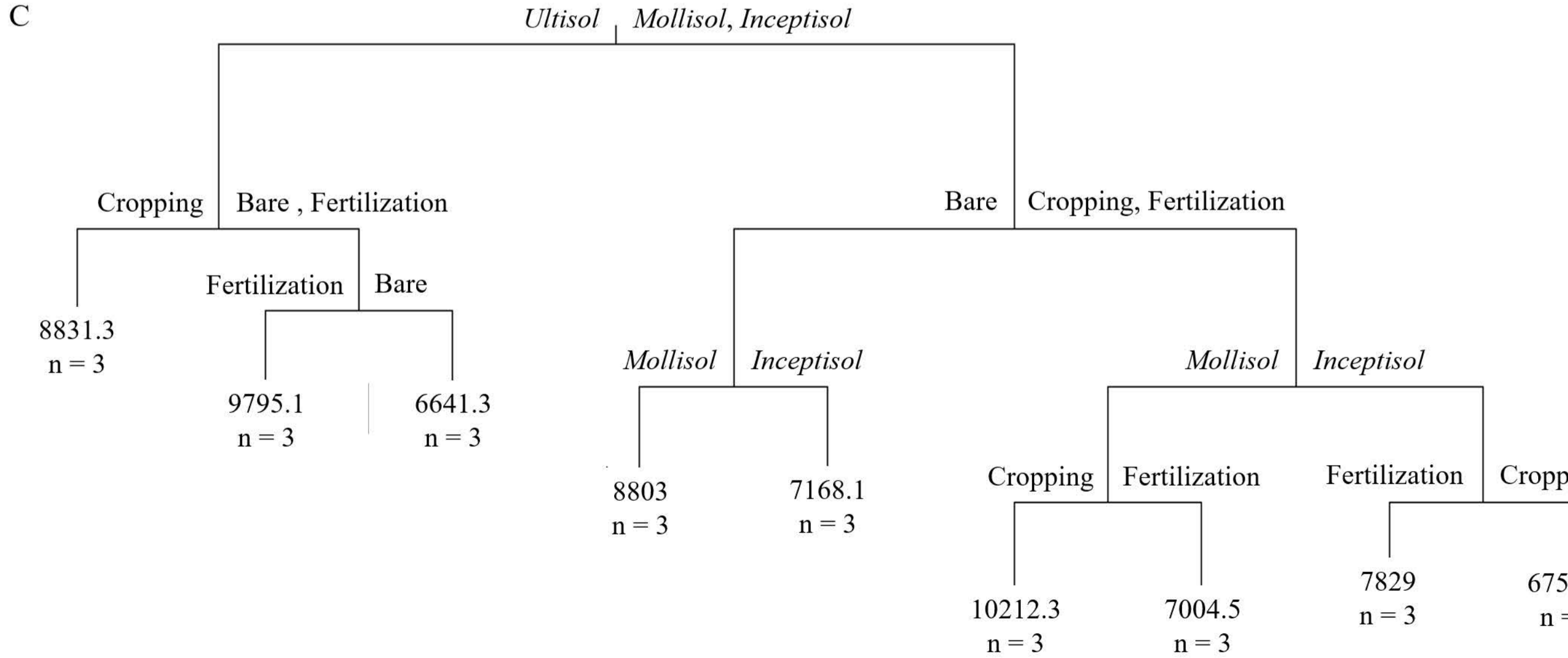
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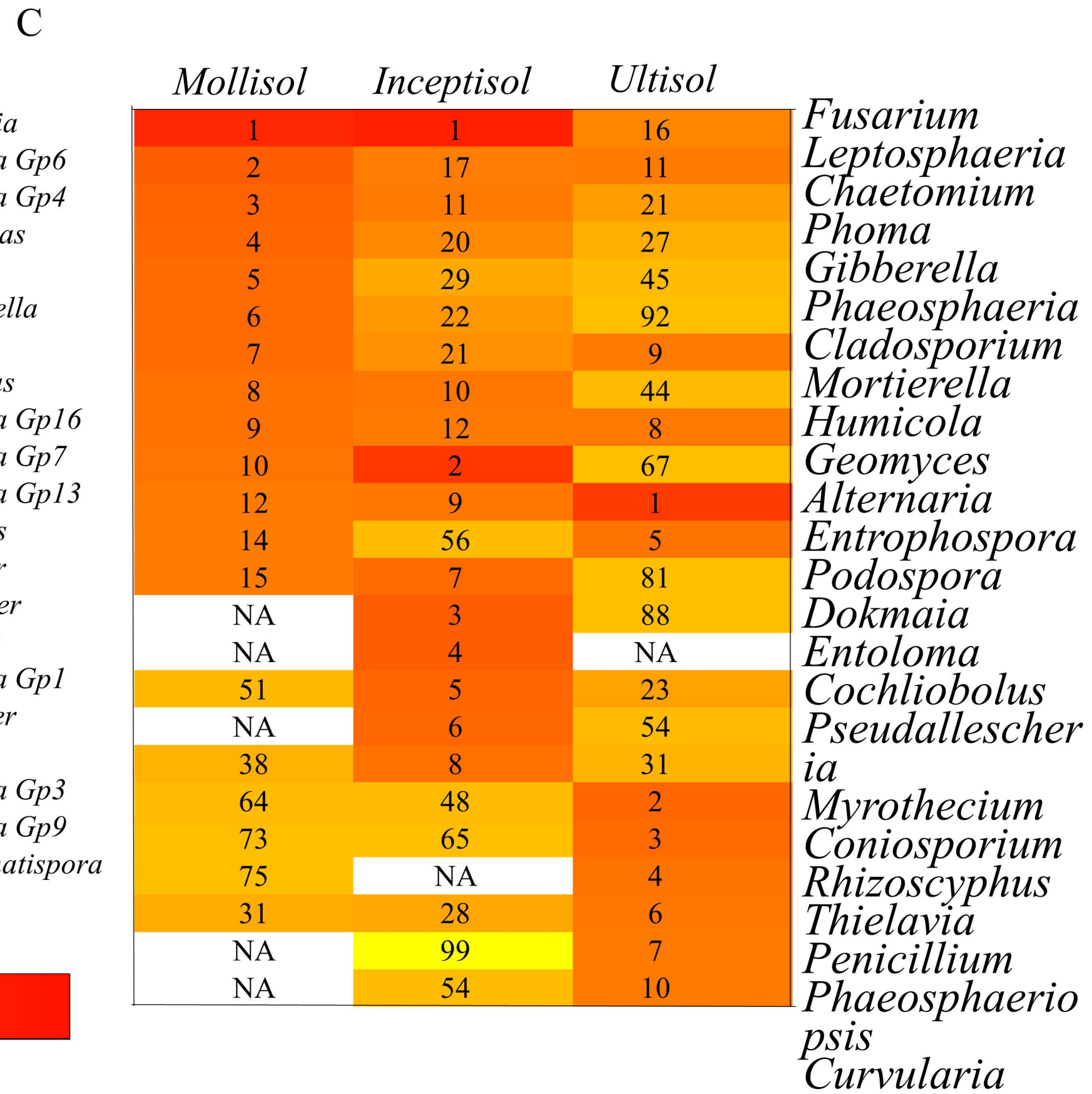
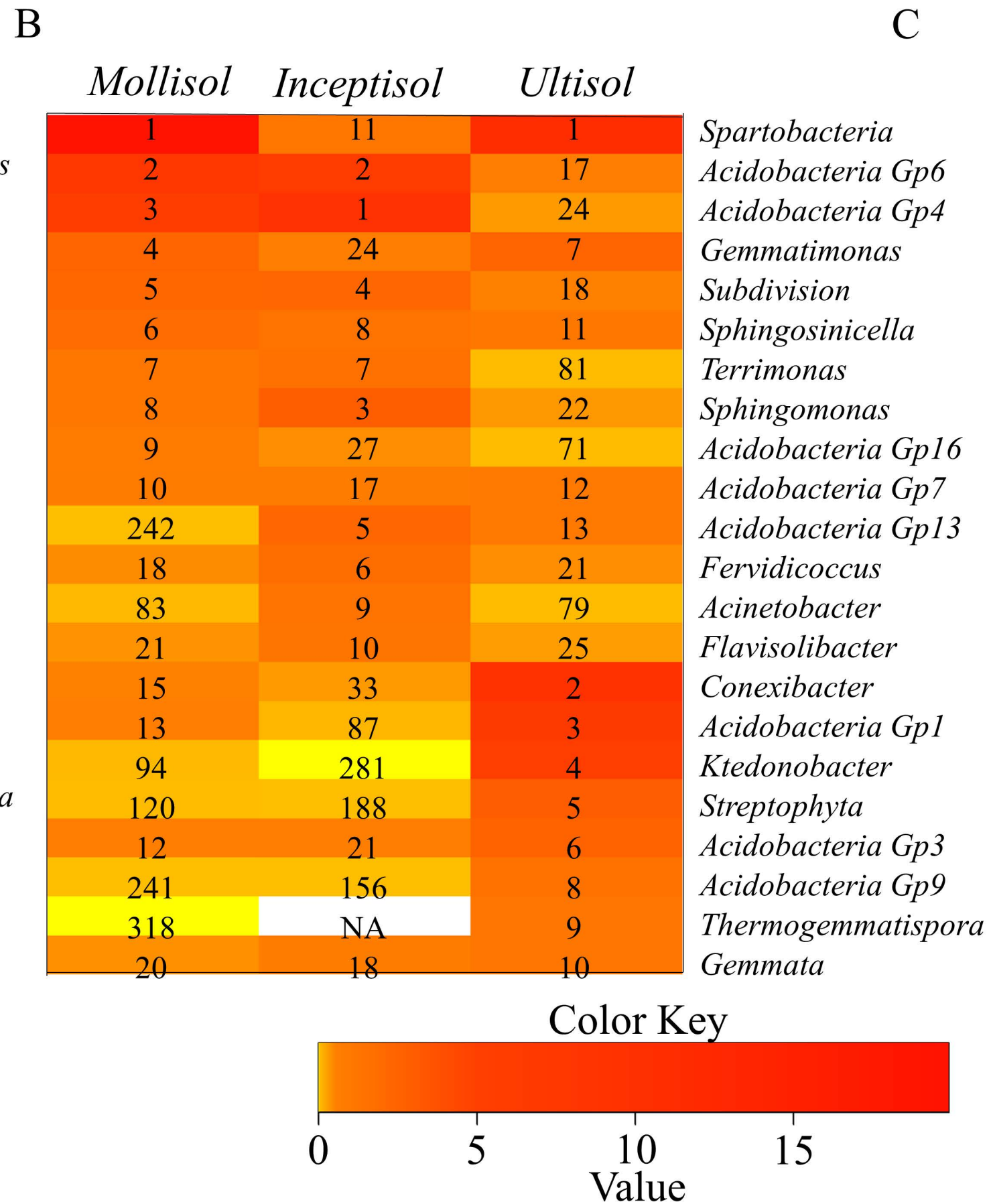
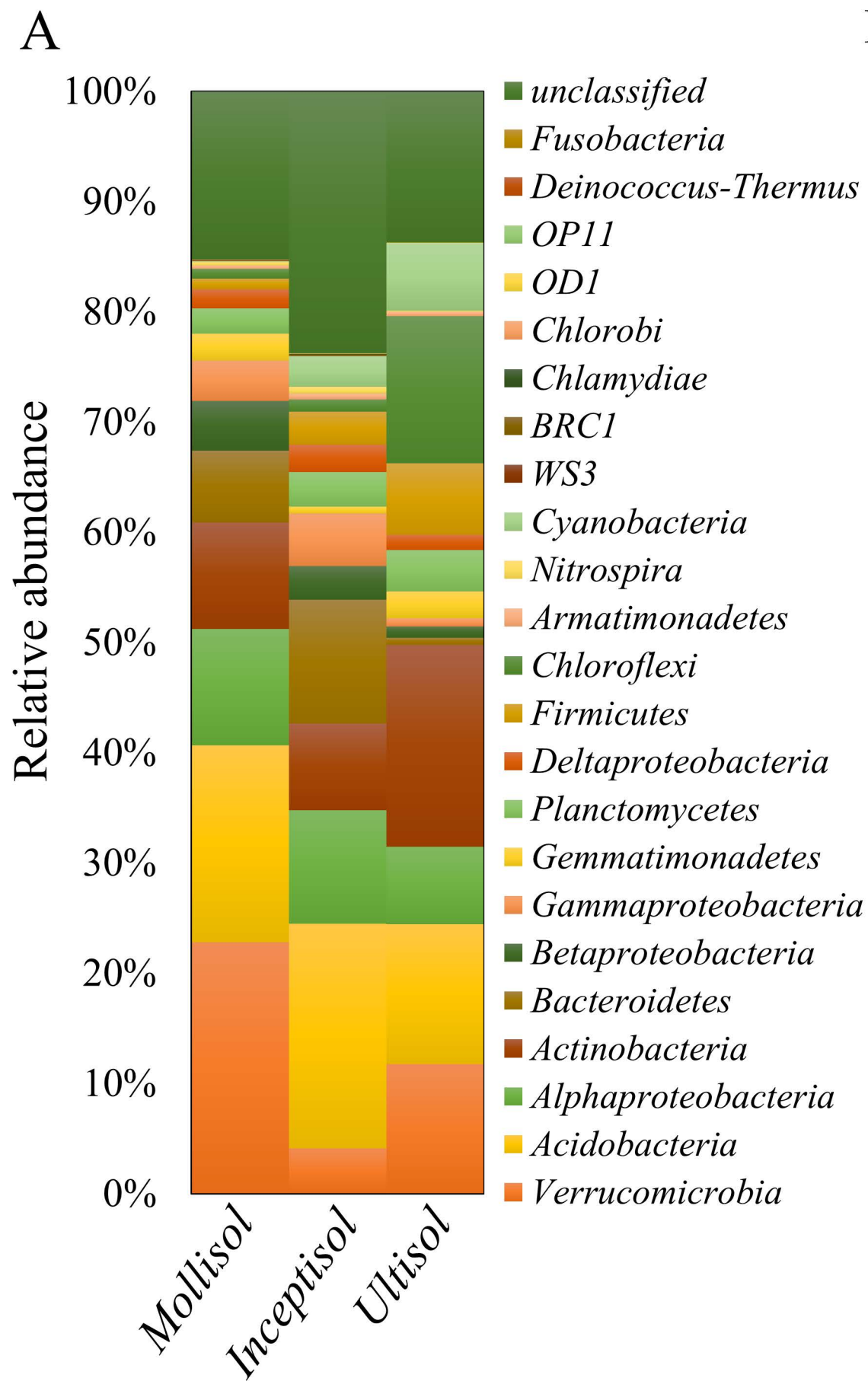


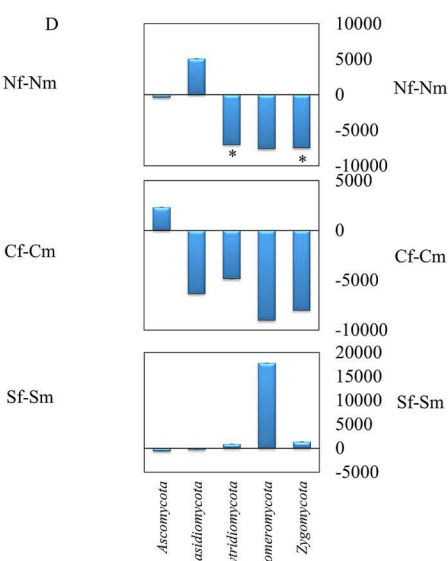
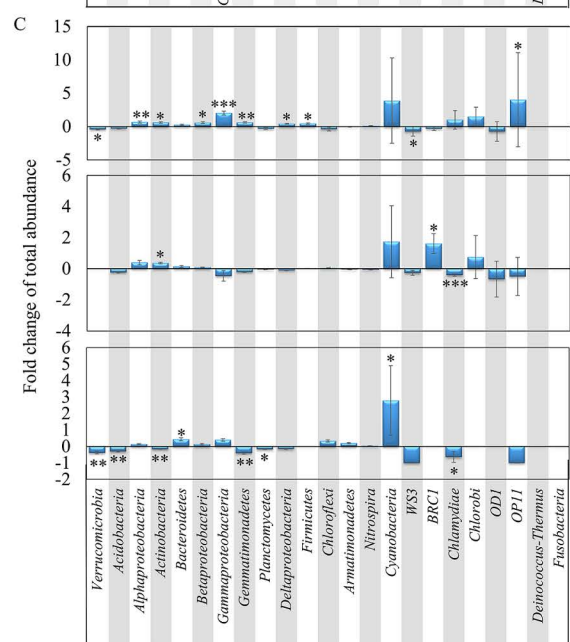
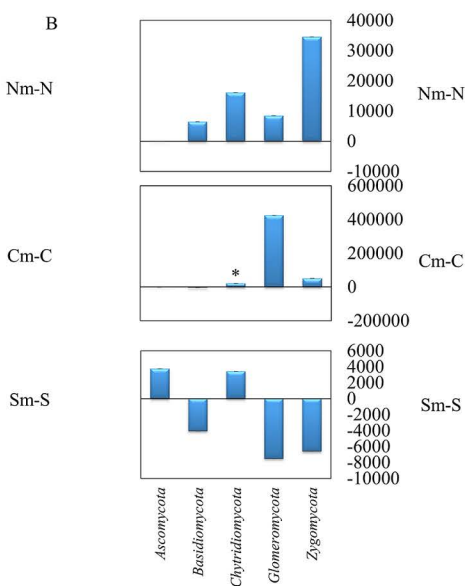
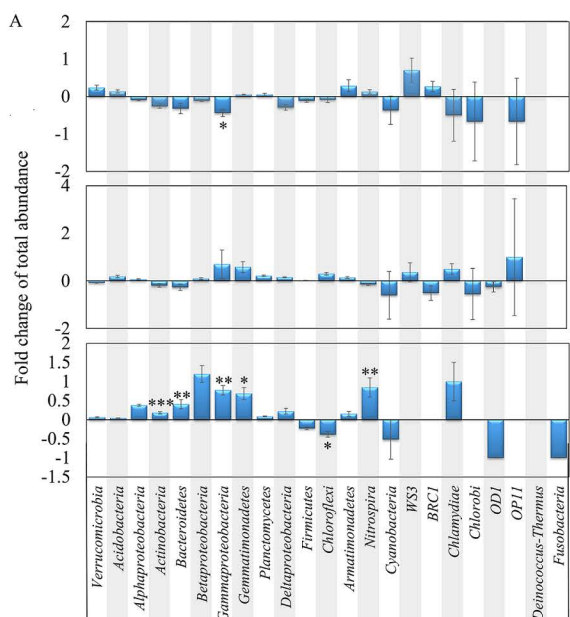
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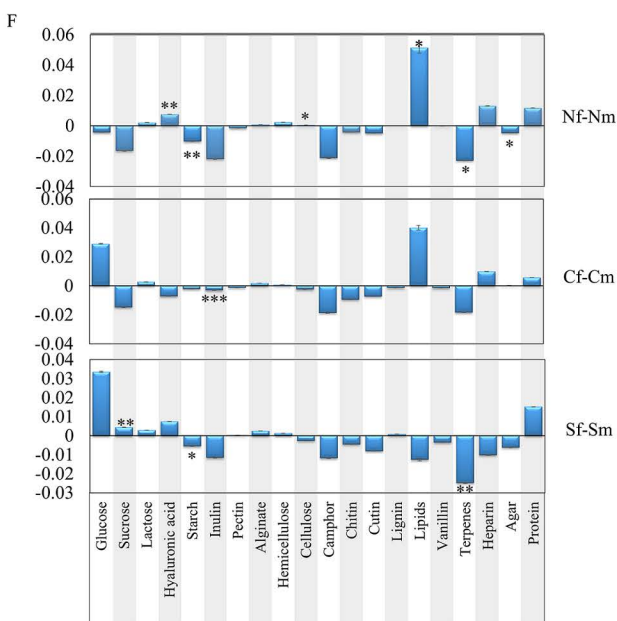
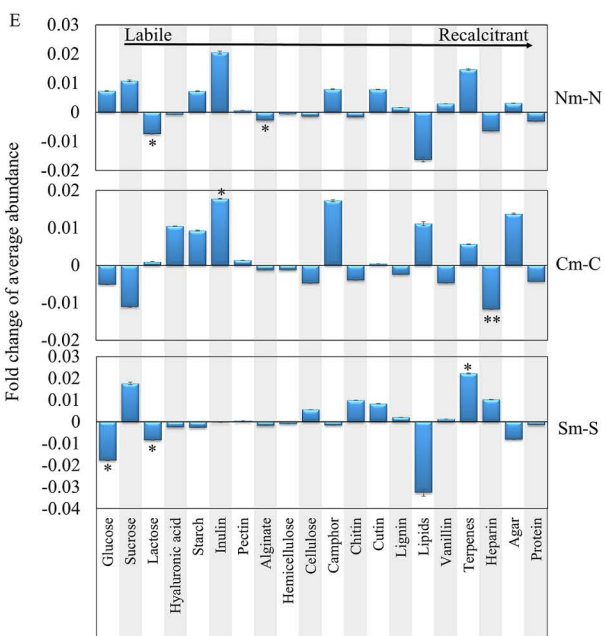
C







\*  $P < 0.050$   
\*\*  $P < 0.010$   
\*\*\*  $P < 0.001$

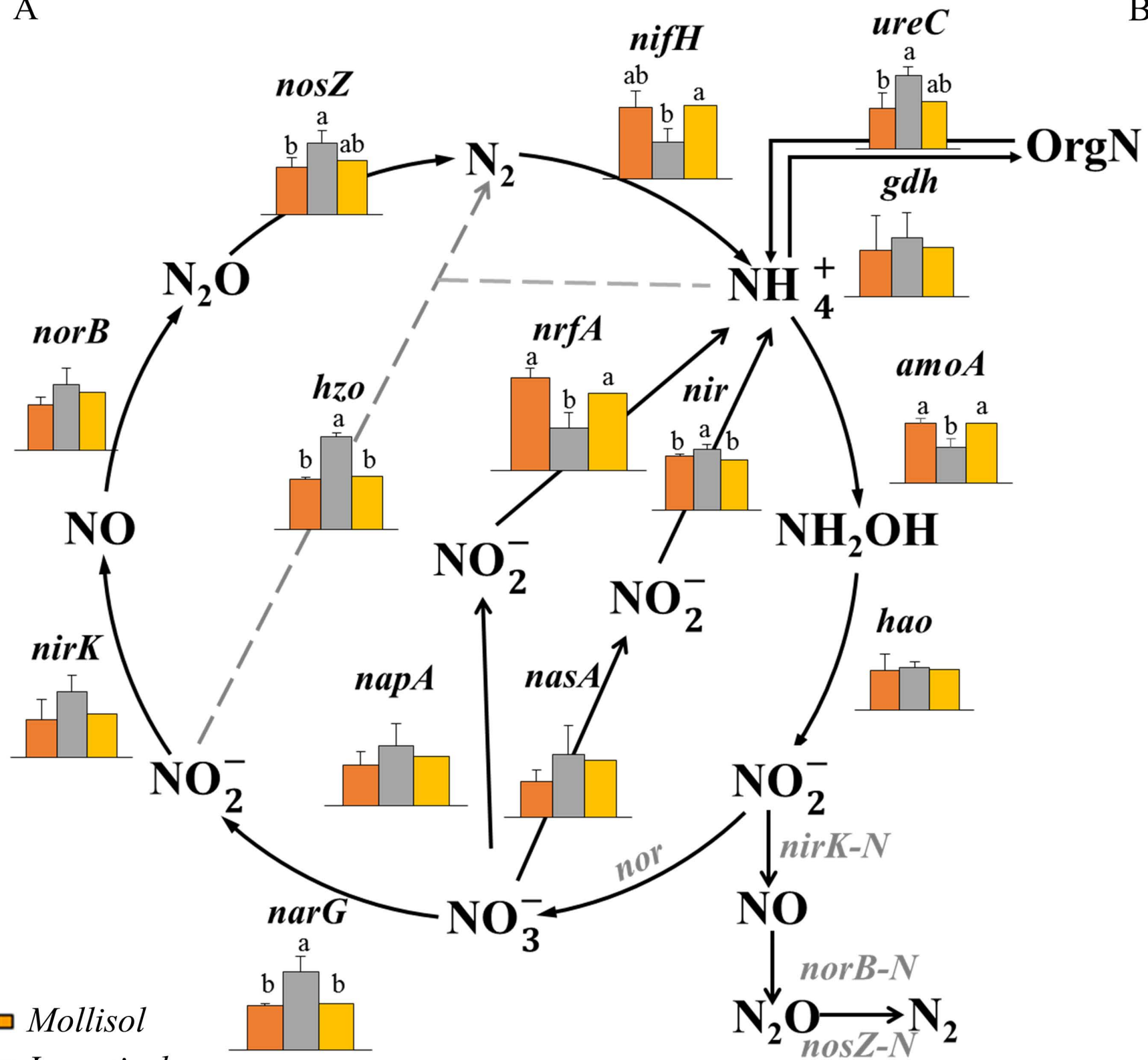


**Table S2** Relative abundance of genus that consistently responded to maize cropping (*Gp7*) or fertilization (*Gp4*, *Gp6* and *Fusarium*)

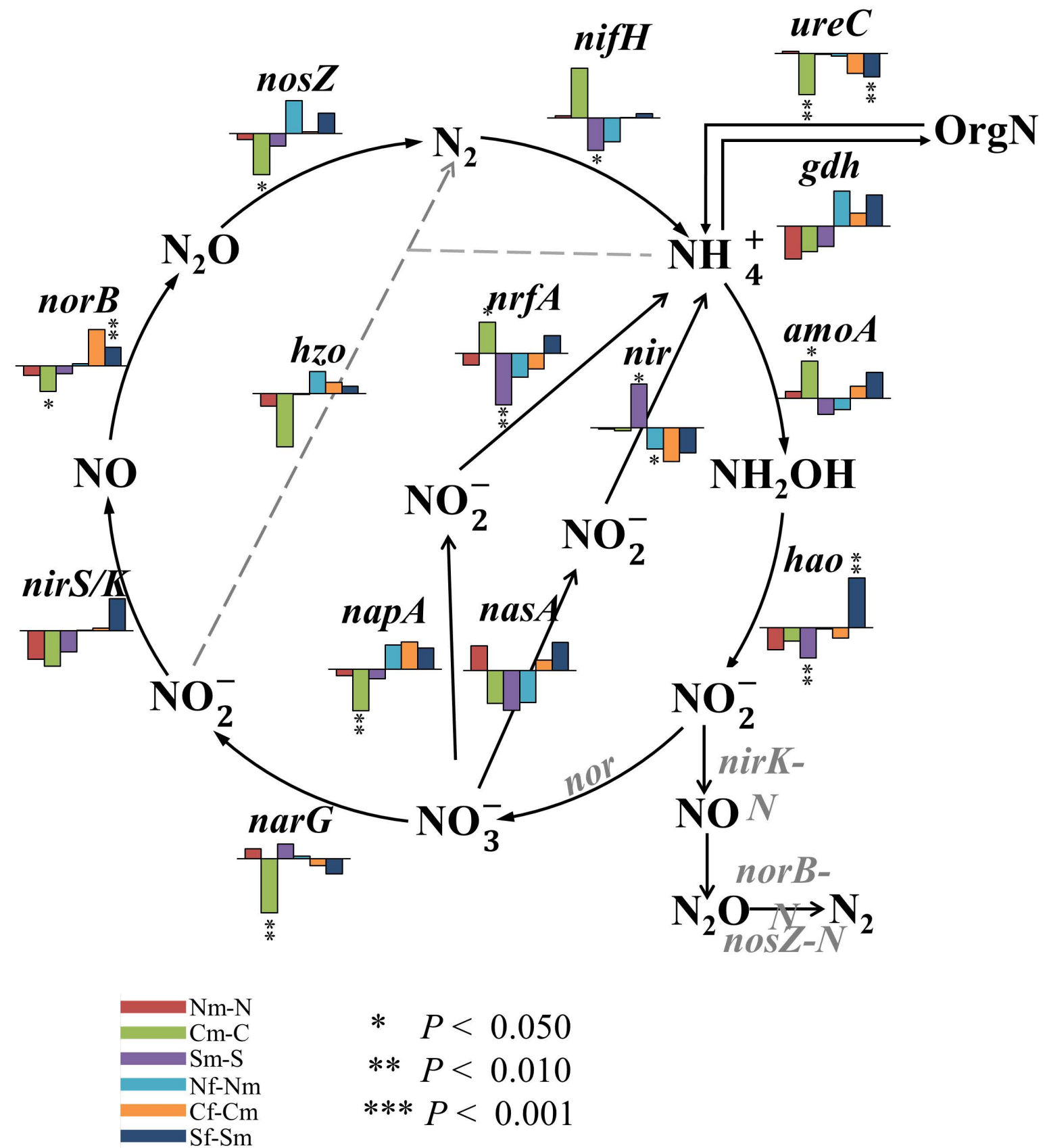
genus	N	Nm	Nf	C	Cm	Cf	S	Sm	Sf
<i>Gp4</i>	5.66 ± 0.97b	6.25 ± 0.75b	2.94 ± 0.26c	9.58 ± 2.41a	10.34 ± 1.98a	6.91 ± 1.42b	0.31 ± 0.12d	0.4 ± 0.11d	0.1 ± 0.02d
<i>Gp6</i>	7.69 ± 2.57ab	8.92 ± 3.18a	5.57 ± 1.44b	6.08 ± 2.42ab	7.89 ± 1.01ab	6.7 ± 0.19ab	0.61 ± 0.09c	0.9 ± 0.24c	0.5 ± 0.1c
<i>Gp7</i>	0.75 ± 0.1c	0.88 ± 0.25bc	0.68 ± 0.17c	0.71 ± 0.08c	0.84 ± 0.08bc	0.89 ± 0.07bc	0.99 ± 0.17b	1.29 ± 0.03a	0.6 ± 0.15c
<i>Fusarium</i>	12.92 ± 6.92a	6.77 ± 1.8ab	14.25 ± 6.71a	14.92 ± 11.45a	7.79 ± 3.57ab	9.48 ± 6.62ab	0.48 ± 0.47b	0.97 ± 0.13b	2.53 ± 1.58b

Letters behind each value indicate significance of differences. Treatments with any same letters are insignificantly different ( $P > 0.05$ ) as determined by one-way ANOVA followed by the LSD test in SAS version 6.1.

A

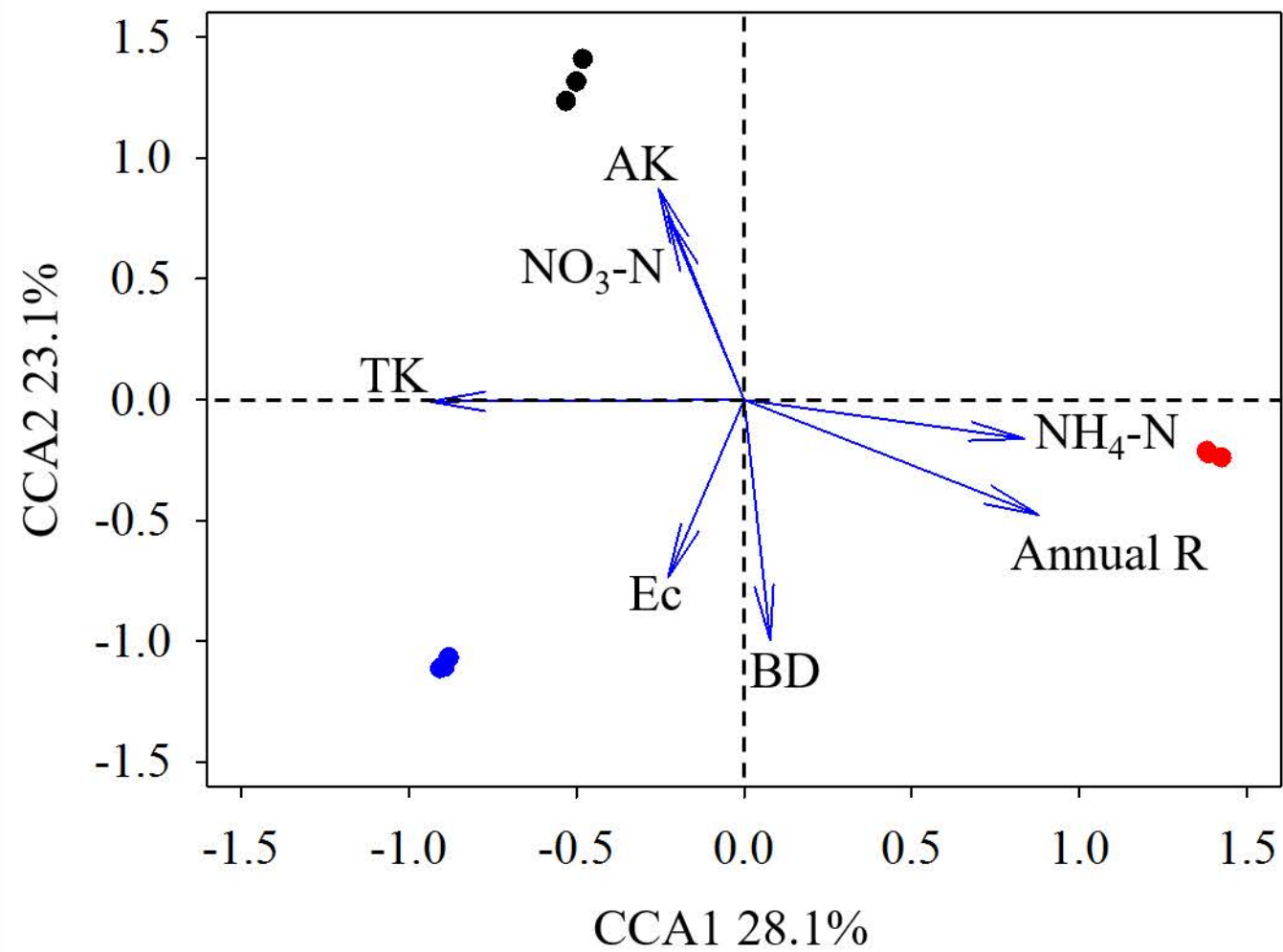


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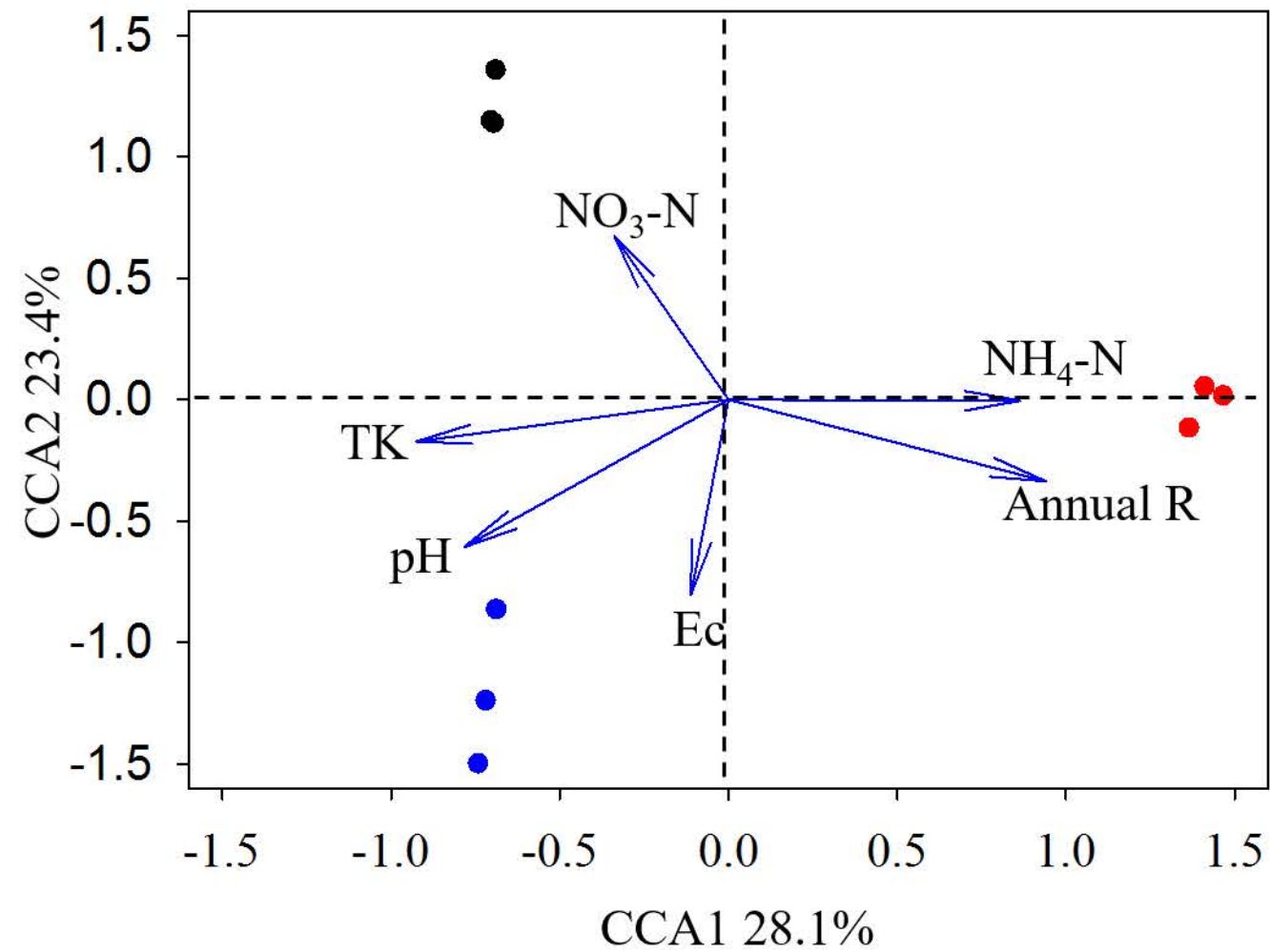




A

 $P = 0.035$ 

B

 $P = 0.003$ 

**Table S3** Mantel tests to determine the significances of correlations between environmental variables and microbial communities in bare fallow soils

	Bacteria		Fungi	
	<i>r</i>	<i>P</i>	<i>r</i>	<i>P</i>
pH	0.84	<b>0.001<sup>b</sup></b>	0.63	<b>0.013</b>
SOM <sup>a</sup>	0.06	0.373	0.11	0.195
WHC	0.12	0.228	0.14	0.187
BD	0.25	<b>0.042</b>	0.19	0.108
Sp	0.20	<b>0.052</b>	0.26	<b>0.050</b>
EC	0.05	0.314	-0.16	0.897
CEC	0.04	0.434	0.10	0.172
TN	-0.03	0.475	0.06	0.244
TP	0.74	<b>0.005</b>	0.74	<b>0.011</b>
TK	0.78	<b>0.005</b>	0.77	<b>0.006</b>
AP	0.19	0.091	0.15	0.131
AK	-0.08	0.675	-0.02	0.483
NH <sub>4</sub> -N	0.51	<b>0.013</b>	0.49	<b>0.015</b>
NO <sub>3</sub> -N	-0.13	0.888	-0.04	0.533
Annual T	0.37	<b>0.035</b>	0.43	<b>0.020</b>
Annual R	0.77	<b>0.009</b>	0.83	<b>0.001</b>

<sup>a</sup>Abbreviation: SOM – soil organic matter, WHC – water hold capacity, BD – soil bulk density, Sp – soil porosity, EC – electrical conductivity, CEC – cation exchange capacity, TN – total nitrogen, TP – total phosphorus, TK – total potassium, AP – available phosphorus, AK - available potassium, Annual T – annual average temperature, Annual R – annual rainfall.

<sup>a</sup>Bold font indicates significant correlation of  $P < 0.050$

