Table S1 Table with raw data might be useful to appreciate real differences between soils.

Sampling points	Soil depth	TN (g/kg)	NO3-N (mg/kg)	NH4-N (mg/kg)	SOC (g/kg)	pH	SMD (μm)	Soil type
1	0-20cm	0.68	22.8	2.42	6.73	6.5	66.53	brown soil
2	0-20cm	0.45	11.7	2.44	8.06	6.2	62.7	brown soil
3	0-20cm	0.96	10.4	2.42	8.35	8.2	67.9	brown soil
4	0-20cm	1.04	8.96	2.41	8.53	8.2	151.59	cinnamon soil
5	0-20cm	0.81	16.1	3.21	7.95	5.1	105.36	cinnamon soil
6	0-20cm	0.98	21.6	3.25	9.51	6.4	120.85	cinnamon soil
7	0-20cm	1.05	95.2	3.28	10.61	5.3	75.02	cinnamon soil
8	0-20cm	0.66	35.9	3.11	6.84	5.3	178.56	cinnamon soil
9	0-20cm	0.69	15.8	2.70	6.96	7.5	101.91	alluvial soil
10	0-20cm	1.03	16.4	2.36	8.70	7.9	70.89	alluvial soil
11	0-20cm	0.82	26.6	2.42	7.83	8.2	77.1	brown soil
1	20-40cm	0.86	10.6	2.42	8.29	7.5	73.97	brown soil
2	20-40cm	0.4	15.7	2.88	4.49	7	70.53	brown soil
3	20-40cm	1.01	4.21	2.94	8.41	8.3	74.84	brown soil
4	20-40cm	0.99	27.8	2.44	7.08	8.2	140.84	cinnamon soil
5	20-40cm	0.53	13.8	2.44	5.39	7	74.24	cinnamon soil
6	20-40cm	0.53	16.1	2.75	5.49	7.3	79.85	cinnamon soil
7	20-40cm	1.01	91	2.67	10.21	7.5	61.07	cinnamon soil
8	20-40cm	0.75	14.4	2.91	3.40	8.1	74.41	cinnamon soil
9	20-40cm	0.31	10.8	2.60	3.58	7.5	107.58	alluvial soil
10	20-40cm	1.05	22.9	2.39	7.66	8.1	45.46	alluvial soil
11	20-40cm	0.89	32.2	2.38	8.47	8	120.36	brown soil
1	40-60cm	0.78	7.88	2.53	7.31	8.1	77.2	brown soil
2	40-60cm	0.36	12.9	2.94	3.80	7.8	72.42	brown soil
3	40-60cm	1.26	7.59	2.89	10.50	8.3	68.32	brown soil
4	40-60cm	0.63	46.1	2.13	4.21	8.2	121.02	cinnamon soil
5	40-60cm	0.63	10.3	2.28	6.15	7.8	45.63	cinnamon soil
6	40-60cm	0.49	25.8	2.67	5.39	7.2	113.97	cinnamon soil
7	40-60cm	0.47	25.3	2.27	4.88	7.4	78.01	cinnamon soil
8	40-60cm	1.13	14.8	2.92	4.23	8.3	33.24	cinnamon soil
9	40-60cm	0.23	8.66	2.50	3.23	8.2	78.24	alluvial soil
10	40-60cm	0.66	10.5	2.69	6.38	8.2	52.57	alluvial soil
11	40-60cm	0.49	33.1	2.27	4.79	8.2	122.39	brown soil
1	60-80cm	0.54	9.95	2.72	5.31	8.1	73.56	brown soil
2	60-80cm	0.31	6.82	2.88	3.38	7.6	66.57	brown soil
3	60-80cm	1.25	6.43	2.85	10.09	8.2	67.22	brown soil
4	60-80cm	0.33	47.8	2.47	3.13	8.1	87.52	cinnamon soil
5	60-80cm	0.73	17.9	2.44	6.90	7.9	46.09	cinnamon soil
6	60-80cm	0.38	21.1	2.60	4.36	7.6	73.48	cinnamon soil
7	60-80cm	0.32	12	2.60	3.87	7.1	86.76	cinnamon soil
8	60-80cm	1.25	13.9	2.61	3.20	8.3	28.95	cinnamon soil

9	60-80cm	0.65	14.3	2.41	6.26	8.3	105.34	alluvial soil
10	60-80cm	0.54	9.83	2.49	5.53	8.2	41.19	alluvial soil
11	60-80cm	0.6	23.1	2.63	3.83	8.2	127.8	brown soil
1	80-100cm	0.66	12	2.42	6.03	8.1	82.47	brown soil
2	80-100cm	0.27	8.39	2.85	3.01	7.6	65.38	brown soil
3	80-100cm	1.08	3.83	2.55	8.06	8.4	70.8	brown soil
4	80-100cm	0.43	49.2	2.58	3.71	8.1	116.3	cinnamon soil
5	80-100cm	0.76	44.7	2.35	8.12	7.5	36.26	cinnamon soil
6	80-100cm	0.31	18.9	2.75	3.67	7.6	71.33	cinnamon soil
7	80-100cm	0.15	11.6	2.77	2.03	6.6	104.21	cinnamon soil
8	80-100cm	1.13	30.8	2.94	3.30	8.2	34.73	cinnamon soil
9	80-100cm	0.62	14.4	2.44	5.44	8.3	76.03	alluvial soil
10	80-100cm	0.55	11.1	2.39	5.73	8.2	46.26	alluvial soil
11	80-100cm	0.41	14.4	2.45	4.29	7.9	169.18	brown soil

Table S2 Numbers of KEGG modules related with soil nitrogen cycle difference among soil depths

Module	M00530	M00531	M00529	M00804	M00175	M00528
Description	Dissimilatory nitrate reduction, nitrate => ammonia	Assimilatory nitrate reduction, nitrate => ammonia	Denitrification, nitrate => nitrogen	Complete nitrification, comammox, ammonia => nitrite => nitrate	Nitrogen fixation, nitrogen => ammonia	Nitrification, ammonia => nitrite
0-20cm	16547.98±2730.43a	6614.76±1564.92a	8211.08±3000.32a	3740.6±1141.48a	546.63±194.45a	596.8±623.67a
20-40cm	13147.1±2844.7b	5130.94±1218.8b	4608.65±1470.85b	2284±712.91b	278.54±146.39b	232.44±110.2b
40-60cm	12054.89±3043.53b	4568.65±1017.94b	4171.24±1155.33b	1951.29±577.66b	457.25±520.95ab	156.39±72.45b
60-80cm	12198.4±2498.88b	4929.7±1215.62b	4408.3±1113.95b	2153.57±603.69b	306.38±226.84ab	201.23±113.68b
80-100cm	12556.92±3142.02b	5036.05±1316.2b	4734.01±1577.01b	2182.05±669.11b	289.18±136.39b	235.6±116.25b

Different letters indicate significant differences ($p < 0.05$).