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Factors affecting ammonia-oxidising microorganisms and potential nitrification rates in southern Australian agricultural soils

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Table S1. Soil physicochemical properties and *amoA* gene counts from all sites

Sample ID	Site use	pH	NH ₄ ⁺ -N (KCl extractable)	NO ₃ ⁻ -N (KCl extractable)	Total Nitrogen	Organic Carbon	Potential nitrification rate	Temperature (average maximum in sampling season)	Rainfall (cumulative over sampling season)	AOA	AOB	AOA:AOB	Sampling season
	(in previous growing season)		(mg kg ⁻¹ dry soil)	(mg kg ⁻¹ dry soil)	(%)	(%)	(mg NO ₃ ⁻ -N formed. kg ⁻¹ dry soil.hr ⁻¹)	(°Celsius)	(mm)	(<i>amoA</i> copies.ng ⁻¹ DNA extracted)	(<i>amoA</i> copies.ng ⁻¹ DNA extracted)	ratio	
WA01	Pasture	6.35	6.93	4.41	0.26	3.27	0.54	25.60	171.50	2106	ND	ND	autumn
WA02	Pasture	6.25	13.47	9.71	0.15	2.21	0.30	25.60	171.50	19650	906	22	autumn
WA03	Cropping (wheat)	5	0.47	5.02	0.08	0.90	0.11	17.50	124.80	61	17400	0	winter
WA04	Native vegetation	5.2	7.28	1.81	0.11	1.77	0.05	17.50	124.80	766	170	5	winter
WA05	Cropping (wheat)	5.3	0.26	8.80	0.19	2.00	0.29	17.50	124.80	11240	12450	1	winter
WA06	Cropping (barley)	4.9	0.38	3.77	0.15	1.47	0.08	24.50	73.10	8125	7560	1	autumn
WA07	Cropping (wheat)	4.3	4.81	4.74	0.09	1.53	0.09	24.50	73.10	5330	5340	1	autumn
WA08	Cropping (lupins)	4.4	20.15	8.10	0.06	1.32	0.00	17.60	79.40	5735	5165	1	winter
WA09	Cropping (wheat)	4.6	4.41	8.01	0.07	1.04	0.14	17.60	79.40	35050	1135	31	winter
WA10	Cropping (canola)	5.4	1.16	8.76	0.28	3.47	0.37	23.40	85.50	2855	642	4	autumn
WA11	Cropping (wheat)	5	2.32	2.96	0.05	0.83	0.04	18.30	103.60	1053	16600	0	winter
WA12	Cropping (wheat)	5.9	2.5	1.73	0.03	0.83	0.09	18.30	103.60	489	9365	0	winter
WA13	Native vegetation	4.5	8.89	6.43	0.04	1.05	0.06	18.30	103.60	24200	12250	2	winter

Sample ID	Site use	pH	NH ₄ ⁺ -N (KCl extractable)	NO ₃ ⁻ -N (KCl extractable)	Total Nitrogen	Organic Carbon	Potential nitrification rate	Temperature (average maximum in sampling season)	Rainfall (cumulative over sampling season)	AOA	AOB	AOA:AOB	Sampling season
	(in previous growing season)		(mg kg ⁻¹ dry soil)	(mg kg ⁻¹ dry soil)	(%)	(%)	(mg NO ₃ ⁻ -N formed. kg ⁻¹ dry soil.hr ⁻¹)	(°Celsius)	(mm)	(<i>amoA</i> copies.ng ⁻¹ DNA extracted)	(<i>amoA</i> copies.ng ⁻¹ DNA extracted)	ratio	
WA14	Cropping (wheat)	5	44.52	7.85	0.05	0.66	0.20	19.90	148.70	847	49650	0	winter
WA15	Cropping (wheat)	5.2	3.16	0.48	0.04	0.72	0.09	19.90	148.70	5335	186	29	winter
WA16	Native vegetation	5	9.05	7.66	0.04	0.72	0.18	19.90	148.70	5800	1577	4	winter
WA17	Cropping (wheat)	4.8	1.56	6.39	0.06	0.80	0.10	19.90	148.70	342	16500	0	winter
WA18	Pasture	5.5	2.49	2.93	0.08	1.71	0.15	18.50	137.80	343	2975	0	winter
WA19	Cropping (canola)	5	2.72	5.36	0.08	1.19	0.07	23.60	126.80	7780	9050	1	autumn
WA20	Cropping (wheat)	7.3	1.32	8.89	0.06	0.90	0.11	24.60	84.10	25200	8875	3	autumn
WA21	Cropping (wheat)	6.1	0.99	0.62	0.01	0.38	0.09	18.90	255.70	35050	52400	1	winter
WA22	Cropping (wheat)	4.6	14.56	4.90	0.09	1.16	0.13	17.80	81.20	7075	2940	2	winter
WA23	Pasture	6.2	4.46	3.68	0.37	5.11	0.68	17.20	274.70	2600	9815	0	winter
WA24	Pasture	5.7	4.4	2.92	0.30	3.13	0.72	17.20	274.70	4530	5625	1	winter
WA25	Cropping (barley)	5.7	3.28	7.14	0.06	1.15	0.19	17.60	99.10	38	13000	0	winter
WA26	Native vegetation	4.1	2.95	0.35	0.02	0.46	0.02	17.60	99.10	6760	ND	ND	winter
WA27	Cropping (barley)	4.3	5.71	6.96	0.08	1.38	0.12	17.60	99.10	58	3000	0	winter
SA68	Cropping	6.1	24.62	36.72	0.08	1.25	0.08	31.30	20.60	19450	1052	18	summer

Sample ID	Site use	pH	NH ₄ ⁺ -N (KCl extractable)	NO ₃ ⁻ -N (KCl extractable)	Total Nitrogen	Organic Carbon	Potential nitrification rate	Temperature (average maximum in sampling season)	Rainfall (cumulative over sampling season)	AOA	AOB	AOA:AOB	Sampling season
	(in previous growing season)		(mg kg ⁻¹ . dry soil)	(mg kg ⁻¹ . dry soil)	(%)	(%)	(mg NO ₃ ⁻ -N formed. kg ⁻¹ dry soil.hr ⁻¹)	(°Celcius)	(mm)	(<i>amoA</i> copies.ng ⁻¹ DNA extracted)	(<i>amoA</i> copies.ng ⁻¹ DNA extracted)	ratio	
SA72	Pasture	4.9	30.06	25.92	0.10	1.28	0.05	30.30	19.10	13500	250	54	summer
SA140	Cropping	7.3	1.59	36.84	0.07	1.01	0.36	31.20	28.30	119000	1365	87	summer
SA182	Pasture	5.4	ND	24.54	0.08	1.22	0.25	30.50	27.10	23300	1560	15	summer
SA197	Pasture	6.9	0.75	49.70	0.15	1.83	0.38	31.00	28.30	11900	250	48	summer
SA202	Cropping	7.6	0.28	19.51	0.13	1.46	0.65	31.50	31.40	1650	686	2	summer
SA218	Cropping	7.4	ND	44.90	0.19	2.15	0.97	30.10	14.20	96450	2935	33	summer
SA249	Cropping	4.4	ND	49.10	0.09	1.09	0.25	29.60	13.50	18300	589	31	summer
SA259	Cropping	5.1	ND	48.62	0.13	1.36	0.18	29.60	20.50	15900	517	31	summer
SA280	Pasture	6	ND	33.61	0.16	2.03	0.52	31.20	7.80	33600	245	137	summer
SA300	Cropping	6.8	0.37	32.90	0.13	1.45	0.45	29.30	6.80	33050	438	75	summer
SA310	Pasture	4.7	1.97	32.88	0.10	0.98	0.14	30.00	15.40	17750	422	42	summer
SA315	Cropping	6.7	1.15	73.52	0.17	2.29	0.56	29.80	13.90	70800	2825	25	summer
SA325	Cropping	6.2	0.73	3.91	0.09	1.43	0.12	30.90	23.40	4760	488	10	summer
SA467	Cropping	7.1	ND	15.25	0.15	1.94	0.18	31.30	21.10	6315	425	15	summer
SA473	Cropping	6.6	ND	14.30	0.02	0.71	0.41	30.20	82.50	36900	441	84	summer
SA476	Cropping	4.6	1.75	21.70	0.04	0.86	0.22	31.20	7.80	54700	954	57	summer
SA500	Cropping	4.3	25.95	73.71	0.14	1.34	0.11	31.30	24.00	6555	2060	3	summer

Table S2. Spearman Rank correlation matrix for data measured at all sites

Figures highlighted in grey are statistically significant at $P < 0.01$. Figures highlighted in bold and italics are statistically significant at $P < 0.05$

AOA	1																	
AOB	-0.25	1																
C:N	-0.05	0.15	1															
Electrical conductivity	0.21	0.04	-0.23	1														
NH ₄ ⁺	-0.3	0.15	0.26	0.03	1													
NO ₃ ⁻	0.59	-0.29	-0.47	0.25	-0.29	1												
PNR	0.22	-0.18	-0.43	0.15	-0.42	0.41	1											
Total Nitrogen	0.01	-0.25	-0.76	0.35	-0.19	0.32	0.55	1										
Organic carbon	-0.04	-0.22	-0.48	0.36	-0.11	0.2	0.49	0.92	1									
pH	0.23	-0.16	-0.12	0.16	-0.42	0.23	0.59	0.32	0.35	1								
Rainfall in sample season	-0.53	0.44	0.3	-0.21	0.41	-0.73	-0.14	-0.19	-0.12	-0.05	1							
Avg max Temp in sample season	0.49	-0.49	-0.26	0.09	-0.32	0.72	0.27	0.17	0.1	0.37	-0.69	1						
Season (winter)	-0.56	0.54	0.39	-0.15	0.45	-0.79	-0.37	-0.35	-0.26	-0.38	0.81	-0.92	1					
Latitude	-0.42	0.34	0.34	-0.32	0.34	-0.44	-0.32	-0.49	-0.45	-0.28	0.53	-0.56	0.71	1				
Longitude	0.58	-0.45	-0.22	0.21	-0.47	0.73	0.13	0.15	0.1	0.17	-0.94	0.75	-0.86	-0.66	1			
Site use	-0.18	0.37	0.05	-0.13	-0.09	-0.16	-0.07	-0.13	-0.14	-0.13	0	-0.13	0.18	0.03	-0.01	1		
Soil texture	-0.45	0.51	0.18	-0.06	0.37	-0.62	-0.38	-0.04	0.07	-0.36	0.63	-0.72	0.72	0.34	-0.62	0.2	1	
	AOA	AOB	C:N	Electrical conductivity	NH ₄ ⁺	NO ₃ ⁻	PNR	Total Nitrogen	Organic carbon	pH	Rainfall in sample season	Avg max Temp in sample season	Season (winter)	Latitude	Longitude	Site use	Soil texture	

Table S3. Spearman Rank correlation matrix for data from WA sites

Figures highlighted in grey are statistically significant at $P < 0.01$. Figures highlighted in bold and italics are statistically significant at $P < 0.05$

AOA	1																
AOB	-0.13	1															
C:N	0.02	-0.01	1														
Electrical conductivity	0.20	0.01	-0.27	1													
NH ₄ ⁺	0.02	-0.33	0.17	0.20	1												
NO ₃ ⁻	0.27	0.10	-0.31	0.34	0.14	1											
PNR	-0.11	-0.28	-0.42	0.27	0.32	0.25	1										
Total Nitrogen	-0.08	-0.25	-0.76	0.36	0.00	0.21	0.63	1									
Organic carbon	-0.08	-0.32	-0.48	0.37	0.10	0.19	0.60	0.92	1								
pH	-0.01	0.06	-0.13	0.03	-0.16	-0.02	0.48	0.24	0.28	1							
Rainfall in sample season	-0.13	0.14	-0.08	-0.11	0.11	-0.21	0.28	0.07	0.03	0.56	1						
Avg max Temp in sample season	0.29	-0.17	-0.03	-0.19	0.07	0.29	-0.06	-0.07	-0.07	0.16	-0.05	1					
Season (winter)	-0.29	0.27	0.34	-0.03	0.09	-0.35	-0.13	-0.42	-0.41	-0.22	0.20	-0.76	1				
Latitude	-0.37	0.13	0.41	-0.23	0.16	-0.12	-0.30	-0.66	-0.61	-0.24	0.11	-0.12	0.63	1			
Longitude	0.28	-0.10	0.10	0.11	-0.18	0.23	-0.34	-0.03	0.02	-0.41	-0.91	0.20	-0.43	-0.36	1		
Site use	-0.19	0.39	-0.17	-0.35	-0.28	0.08	-0.03	-0.05	-0.17	-0.19	-0.35	0.00	0.09	0.06	0.23	1	
Soil texture	0.03	0.06	-0.08	0.05	-0.35	-0.02	-0.12	0.37	0.45	0.03	-0.30	-0.21	-0.21	-0.52	0.43	0.01	1
	AOA	AOB	C:N	Electrical conductivity	NH ₄ ⁺	NO ₃ ⁻	PNR	Total Nitrogen	Organic carbon	pH	Rainfall in sample season	Avg max Temp in sample season	Season (winter)	Latitude	Longitude	Site use	Soil texture