

*Supplement of*

**Nitrifier denitrification potentially dominates N<sub>2</sub>O production in a sandy soil – results from different fertilization and irrigation regimes in potato cropping in Germany**

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**Table S1: Overview of water and nitrogen (N) fertilizer application with indication of the date and amount for the investigated treatments ZI-ZN (zero irrigation without (zero) N application), ZI-N (zero irrigation with N application), SI-ZN (sprinkler irrigation without (zero) N application), SI-N (sprinkler irrigation with N application), DI-ZN (drip irrigation without (zero) N application), DI-N (drip irrigation with N application), F (fertigation) and F-ZC (fertigation without (zero) crops). Marked in bold are sampling dates for functional genes analysis.**

Sampling date	<b>26.05.20</b>	09.06.20	16.06.20	23.06.20	<b>30.06.20</b>	07.07.20	<b>14.07.20</b>	21.07.20	28.07.20		04.08.20		11.08.20	
Air temperature [°C]	19.0	21.1	25.8	24.7	21.2	17.9	28.2	22.0	26,7		24.3		31.0	
Soil temperature [°C]	12.6	17.3	19.0	17.9	16.2	15.4	17.3	17.5	19,7		17.1		23.1	
Precipitation [mm]	16.3	0.1	12.5	2.3	11.2	3.0	0.0	0.1	4,2		3.1		0.7	
Application date		09.06.20	18.06.20	24.06.20	01.07.20	07.07.20	14.07.20	21.07.20	23.07.20	30.07.20	03.08.20	04.08.20	07.08.20	12.08.20
Water supply [L m <sup>-2</sup> ]	ZI-ZN	0	0	0	0	0	0	0	0	0	0	0	0	0
	SI-ZN	0	10	0	15	0	0	0	10	15	15	15	0	15
	DI-ZN	0	3.11	0	4.66	0	0	0	3.11	4.66	4.66	4.66	0	4.66
	ZI-N	0	0	0	0	0	0	0	0	0	0	0	0	0
	SI-N	0	10	0	15	0	0	0	10	15	15	15	0	15
	DI-N	0	3.11	0	4.66	0	0	0	3.11	4.66	4.66	4.66	0	4.66
	F	0	3.11	3.11	4.66	3.11	3.11	3.11	3.11	4.66	4.66	0	4.66	4.66
	F-ZC	0	3.11	3.11	4.66	3.11	3.11	3.11	3.11	4.66	4.66	0	4.66	4.66
Nitrogen supply [kg N ha <sup>-1</sup> ]	ZI-ZN	0	0	0	0	0	0	0	0	0	0	0	0	0
	SI-ZN	0	0	0	0	0	0	0	0	0	0	0	0	0
	DI-ZN	0	0	0	0	0	0	0	0	0	0	0	0	0
	ZI-N	0	75	0	0	0	45.33	0	0	0	0	0	30	0
	SI-N	0	75	0	0	0	45.33	0	0	0	0	0	30	0
	DI-N	0	75	0	0	0	45.33	0	0	0	0	0	30	0
	F	0	7.75	7.75	11.63	15.5	15.5	15.5	15.5	0	15.5	0	15.5	0
	F-ZC	0	7.75	7.75	11.63	15.5	15.5	15.5	15.5	0	15.5	0	15.5	0

**Table S1: continued.**

Sampling date	18.08.20	<b>25.08.20</b>	01.09.20	08.09.20	<b>15.09.20</b>
Air temperature [°C]	21.9	19.7	21.4	21.7	27.8
Soil temperature [°C]	23.2	18.5	14.4	14.5	18,0
Precipitation [mm]	0.1	5.1	17.1	3.5	0.0
Application date	19.08.20	27.08.20	03.09.20	09.09.20	harvest
Water supply [L m <sup>-2</sup> ]	ZI-ZN	0	0	0	0
	SI-ZN	10	0	0	0
	DI-ZN	3.11	0	0	0
	ZI-N	0	0	0	0
	DI-N	3.11	0	0	0
	SI-N	10	0	0	0
	F	3.11	3.11	3.11	3.11
	F-ZC	3.11	3.11	3.11	3.11
Nitrogen supply [kg N ha <sup>-1</sup> ]	ZI-ZN	0	0	0	0
	SI-ZN	0	0	0	0
	DI-ZN	0	0	0	0
	ZI-N	0	0	0	0
	SI-N	0	0	0	0
	DI-N	0	0	0	0
	F	7.75	3.88	3.88	3.88
	F-ZC	7.75	3.88	3.88	3.88

**Table S2: Seasonal N<sub>2</sub>O flux rates in  $\mu\text{g N}_2\text{O-N m}^{-2} \text{h}^{-1}$  given as median value of three field replicates. Factor of change in N<sub>2</sub>O flux rates for the investigated treatment each compared to the untreated reference treatment zero irrigation without (zero) ZI-ZN. Abbreviations: ZI-N (zero irrigation with N application), SI-ZN (sprinkler irrigation without (zero) N application), SI-N (sprinkler irrigation with N application), DI-ZN (drip irrigation without (zero) N application), DI-N (drip irrigation with N application), F (fertigation) and F-ZC (fertigation without (zero) crops). Marked in bold are sampling dates for functional genes analysis.**

Sampling date	Seasonal N <sub>2</sub> O flux rates per treatment							
	ZI-ZN	SI-ZN	DI-ZN	ZI-N	SI-N	DI-N	F	F-ZC
<b>26.05.20</b>	5.0	27.4	8.2	21.8	22.8	13.8	28.9	18.2
09.06.20	34.5	54.7	14.3	6.1	37.3	74.5	32.2	-11.0
16.06.20	25.6	40.0	30.7	38.1	28.0	43.3	34.8	-1.9
23.06.20	11.8	26.6	16.5	9.9	26.5	19.3	6.4	2.2
<b>30.06.20</b>	5.3	24.2	21.1	42.6	47.9	46.0	75.1	28.8
07.07.20	-9.7	9.2	-10.8	19.1	50.6	71.7	13.9	-1.3
<b>14.07.20</b>	22.8	32.8	8.7	11.5	52.1	80.4	34.7	43.0
21.07.20	-17.8	35.3	-8.1	50.2	12.5	9.7	28.4	17.7
28.07.20	-0.8	14.3	9.5	43.0	13.3	13.6	22.6	17.5
04.08.20	8.2	24.3	26.6	9.9	17.9	20.9	46.4	14.2
11.08.20	-5.5	23.3	18.1	14.8	27.7	13.8	7.8	12.9
18.08.20	-1.2	20.3	-2.9	10.7	19.3	19.5	12.1	0.7
<b>25.08.20</b>	6.5	3.3	30.1	14.2	3.8	5.8	9.4	4.5
01.09.20	24.8	12.5	10.3	-9.2	14.3	12.1	15.4	-5.4
08.09.20	15.6	9.1	-3.9	28.3	7.9	12.8	1.8	9.1
<b>15.09.20</b>	21.7	-1.6	-1.7	3.0	4.1	10.3	2.1	4.0
Seasonal median	7.3	23.7	9.9	14.5	21.1	16.5	19.0	6.8
Factor of change		3.2	1.4	2.0	2.9	2.3	2.6	0.9

**Table S3: (a) Modell parameter (chi square and  $p$  values) of linear mixed effects models with ‘N<sub>2</sub>O flux’ as response variable and ‘week’ as explanatory variables. A separate model was fitted for each treatment: ZI-ZN (zero irrigation without (zero) nitrogen (N) fertilizer), SI-ZN (sprinkler irrigation without (zero) nitrogen (N) fertilizer), and DI-ZN (drip irrigation without (zero) nitrogen (N) fertilizer). (b) Seasonal development of N<sub>2</sub>O fluxes during the growing season for the three different treatments: ZI-ZN, SI-ZN, and DI-ZN shown are the median values per treatment and sampling date. Differences in lowercase letters (Group) indicate significant differences between sampling weeks (ANOVA followed by Tukey post-hoc-test). (c) Seasonal median values for each treatment with corresponding factor of change compared to reference treatment (ZI-ZN). Values with \*, \*\*, \*\*\* indicate significance at  $p < 0.05, 0.01, 0.001$ .**

Treatment		ZI-ZN		SI-ZN		DI-ZN	
(a)	ANOVA	<i>chi square:</i> 23.946	<i>p:</i> 0.0060**	<i>chi square:</i> 11.87	<i>p:</i> 0.6884	<i>chi square:</i> 32.164	<i>p:</i> <0.0061***
(b)	Sampling date	Median	Group	Median	Group	Median	Group
	26.05.20	5.02	ab	27.10	a	8.21	a
	09.06.20	34.53	b	54.66	a	14.32	a
	16.06.20	25.60	ab	39.97	a	30.69	a
	23.06.20	1178	ab	26.63	a	16.54	a
	30.06.20	5.34	ab	24.24	a	21.10	a
	07.07.20	-9.74	ab	9.16	a	-10.77	a
	14.07.20	22.75	ab	32.80	a	8.70	a
	21.07.20	-17.78	a	35.26	a	-8.09	a
	28.07.20	-0.82	ab	14.30	a	9.54	a
	04.08.20	8.16	ab	24.32	a	26.59	a
	11.08.20	-5.45	ab	23.25	a	18.06	a
	18.08.20	-1.25	ab	20.26	a	-2.91	a
	25.08.20	6.48	ab	3.26	a	30.08	a
	01.09.20	24.83	ab	12.54	a	10.34	a
	08.09.20	15.60	ab	9.15	a	-3.91	a
	15.09.20	21.74	ab	-1.64	a	-1.66	a
(c)	Seasonal median	7.3		23.7		9.9	
	Factor of change			3.2		1.4	

**Table S3: (a) Modell parameter (chi square and  $p$  values) of linear mixed effects models with ‘N<sub>2</sub>O flux’ as response variable and ‘week’ as explanatory variables. A separate model was fitted for each treatment: ZI-N (zero irrigation with nitrogen (N) fertilizer), SI-N (sprinkler irrigation with N fertilizer), DI-N (drip irrigation with N fertilizer), F (fertigation and FZ-C (fertigation without (zero) crops). (b) Seasonal development of N<sub>2</sub>O fluxes during the growing season for the three different treatments: ZI-N, SI-N, DI-N, F and FZC shown are the median values per treatment and sampling date. Differences in lowercase letters (Group) indicate significant differences between sampling weeks (ANOVA followed by Tukey post-hoc-test). (c) Seasonal median values for each treatment with corresponding factor of change compared to reference treatment (ZI-ZN). Values with \*, \*\*, \*\*\* indicate significance at  $p < 0.05, 0.01, 0.001$ .**

Treatment		ZI-N		SI-N		DI-N		F		F-ZC	
(a)	ANOVA	<i>chi square:</i> 23.427	$p: 0.0445^*$	<i>chi square:</i> 42.624	$p: 0.0018^{**}$	<i>chi square:</i> 24.584	$p: 0.0558$	<i>chi square:</i> 19.965	$p: 0.1733$	<i>chi square:</i> 10.876	$p: 0.7613$
(b)	Sampling date	Median	Group	Median	Group	Median	Group	Median	Group	Median	Group
	26.05.20	21.83	a	22.82	abc	13.78	a	28.93	a	18.18	a
	09.06.20	6.07	a	37.28	abc	74.49	a	32.21	a	-10.98	a
	16.06.20	38.13	a	28.00	abc	43.33	a	34.84	a	-1.92	a
	23.06.20	9.88	a	26.52	abc	19.29	a	6.45	a	2.15	a
	30.06.20	42.62	a	47.87	bc	45.97	a	75.12	a	28.76	a
	07.07.20	19.10	a	50.65	bc	71.65	a	13.93	a	-1.32	a
	14.07.20	11.53	a	52.05	bc	80.40	a	34.71	a	42.98	a
	21.07.20	50.23	a	12.53	a	9.68	a	28.40	a	17.74	a
	28.07.20	43.03	a	13.30	abc	13.60	a	22.60	a	17.49	a
	04.08.20	9.88	a	17.91	abc	20.89	a	46.38	a	14.22	a
	11.08.20	14.80	a	27.74	abc	13.78	a	7.80	a	12.91	a
	18.08.20	10.67	a	19.30	abc	19.49	a	12.08	a	0.73	a
	25.08.20	14.21	a	3.77	ab	5.79	a	9.41	a	4.49	a
	01.09.20	-9.20	a	14.33	abc	12.10	a	15.36	a	-5.37	a
	08.09.20	28.29	a	7.90	abc	12.83	a	1.79	a	9.13	a
	15.09.20	3.03	a	4.08	abc	10.28	a	2.07	a	3.96	a
(c)	Seasonal median	14.5		21.1		16.5		19.0		6.8	
	Factor of change	2.0		2.9		2.3		2.6		0.6	

**Table S4: Median values of the gene copy numbers per gram soil of the nitrogen cycle for the investigated treatments ZI-ZN (zero irrigation without (zero) N application), ZI-N (zero irrigation with N application), SI-ZN (sprinkler irrigation without (zero) N application), SI-N (sprinkler irrigation with N application), DI-ZN (drip irrigation without (zero) N application), DI-N (drip irrigation with N application), F (fertigation) and F-ZC (fertigation without (zero) crops) of the ridge (0-10cm). Modell parameter (*F* and *p* values) of generalized mixed effects models with 'gene copy numbers' as response variable and 'week' as explanatory variables. A separate model was fitted for each treatment. Differences in lowercase letters indicate significant differences between sampling weeks (ANOVAs followed by Tukey post-hoc tests, *p* < 0.05) under consideration that sampling dates were uneven in time space. *amoA* = gene encoding ammonium monoxygenase, *nxrB* = gene encoding nitrite oxidoreductase, *narG* = gene encoding nitrate reductase, *nirK/nirS* = gene encoding nitrite reductase and *nosZ* = encoding nitrous oxide (N<sub>2</sub>O) reductase.**

Sampling date*	26.05.20	30.06.20	14.07.20	25.08.20	15.09.20	ANOVA	
						F	<i>p</i>
<b><i>amoA</i></b>							
ZI-ZN	9.67 x10 <sup>4</sup>	2.34 x10 <sup>4</sup>	3.50 x10 <sup>4</sup>	6.29 x10 <sup>4</sup>	4.40 x10 <sup>4</sup>	6.798	0.0065
SI-ZN	1.30x10 <sup>5</sup> b	3.20 x10 <sup>4</sup> a	5.21x10 <sup>4</sup> a	5.52 x10 <sup>4</sup> a	4.39x10 <sup>4</sup> a	27.841	<0.05
DI-ZN	4.03 x10 <sup>4</sup>	3.41 x10 <sup>4</sup>	6.77 x10 <sup>4</sup>	2.93 x10 <sup>4</sup>	2.86 x10 <sup>4</sup>	3.327	0.056
ZI-N	6.32 x10 <sup>4</sup> ab	3.36x10 <sup>4</sup> a	7.45x10 <sup>4</sup> b	5.55x10 <sup>4</sup> ab	3.48x10 <sup>4</sup> ab	4.381	<0.05
SI-N	4.42 x10 <sup>4</sup> a	3.37x10 <sup>4</sup> a	8.24x10 <sup>4</sup> b	4.21x10 <sup>4</sup> ab	3.94x10 <sup>4</sup> a	5.576	<0.05
DI-N	4.02 x10 <sup>4</sup> ab	2.87x10 <sup>4</sup> ab	1.05x10 <sup>4</sup> b	3.02x10 <sup>4</sup> a	3.11x10 <sup>4</sup> ab	9.842	<0.05
F	1.66x10 <sup>5</sup> b	3.26 x10 <sup>4</sup> ab	6.03x10 <sup>4</sup> ab	4.96 x10 <sup>4</sup> a	5.61x10 <sup>4</sup> a	32.316	<0.05
F-ZC	1.00x10 <sup>5</sup> b	2.34 x10 <sup>4</sup> a	4.51 x10 <sup>4</sup> a	5.21 x10 <sup>4</sup> a	3.20 x10 <sup>4</sup> a	10.187	<0.05
<b><i>nxrB</i></b>							
ZI-ZN	2.67 x10 <sup>5</sup>	3.64 x10 <sup>5</sup>	3.13 x10 <sup>5</sup> a	2.79 x10 <sup>5</sup>	2.15 x10 <sup>5</sup>	1.416	0.979
SI-ZN	2.47 x10 <sup>5</sup>	2.92 x10 <sup>5</sup>	2.39 x10 <sup>5</sup>	3.02 x10 <sup>5</sup>	3.00 x10 <sup>5</sup>	1.561	0.258
DI-ZN	2.07 x10 <sup>5</sup>	3.05 x10 <sup>5</sup>	3.34 x10 <sup>5</sup>	5.02 x10 <sup>5</sup>	3.34 x10 <sup>5</sup>	2.302	0.130
ZI-N	2.47 x10 <sup>5</sup>	2.14x10 <sup>5</sup>	1.67 x10 <sup>5</sup>	2.68x10 <sup>5</sup>	2.95 x10 <sup>5</sup>	2.650	0.096
SI-N	2.39 x10 <sup>5</sup> a	2.58x10 <sup>5</sup> ab	3.81 x10 <sup>5</sup> ab	5.05x10 <sup>5</sup> b	4.50x10 <sup>5</sup> ab	3.962	<0.05
DI-N	2.45x10 <sup>5</sup>	3.10 x10 <sup>5</sup>	2.80 x10 <sup>5</sup>	3.92 x10 <sup>5</sup>	3.91 x10 <sup>5</sup>	1.525	0.387
F	2.94x10 <sup>5</sup>	3.58 x10 <sup>5</sup>	3.11 x10 <sup>5</sup>	3.68 x10 <sup>5</sup>	3.68 x10 <sup>5</sup>	2.981	0.073
F-ZC	3.54x10 <sup>5</sup>	2.72 x10 <sup>5</sup>	2.80x10 <sup>5</sup>	2.96 x10 <sup>5</sup>	2.30 x10 <sup>5</sup>	1.012	0.446
<b><i>narG</i></b>							
ZI-ZN	3.12 x10 <sup>7</sup> c	2.22 x10 <sup>7</sup> b	2.25 x10 <sup>7</sup> bc	1.35 x10 <sup>7</sup> a	1.16 x10 <sup>7</sup> a	33.486	<0.05
SI-ZN	2.78 x10 <sup>7</sup> a	2.25 x10 <sup>7</sup> c	1.66 x10 <sup>7</sup> b	1.24 x10 <sup>7</sup> a	2.02 x10 <sup>7</sup> bc	32.190	<0.05
DI-ZN	1.73 x10 <sup>7</sup> ab	3.32 x10 <sup>7</sup> b	3.14 x10 <sup>7</sup> ab	1.95 x10 <sup>7</sup> a	1.13 x10 <sup>7</sup> a	12.200	<0.05
ZI-N	1.82 x10 <sup>7</sup> ab	2.58 x10 <sup>7</sup> b	2.22 x10 <sup>7</sup> ab	1.67 x10 <sup>7</sup> a	1.25 x10 <sup>7</sup> a	5.440	<0.05
SI-N	1.62 x10 <sup>7</sup> a	2.83 x10 <sup>7</sup> b	3.30 x10 <sup>7</sup> b	1.90 x10 <sup>7</sup> a	1.46 x10 <sup>7</sup> a	17.016	<0.05
DI-N	1.67 x10 <sup>7</sup> a	2.75 x10 <sup>7</sup> b	2.65 x10 <sup>7</sup> b	1.69 x10 <sup>7</sup> a	1.43 x10 <sup>7</sup> a	10.928	<0.05
F	3.39 x10 <sup>7</sup> d	2.33 x10 <sup>7</sup> c	2.00 x10 <sup>7</sup> b	1.26 x10 <sup>7</sup> a	1.98 x10 <sup>7</sup> bc	47.064	<0.05
F-ZC	3.58 x10 <sup>7</sup> b	1.88 x10 <sup>7</sup> a	1.73 x10 <sup>7</sup> a	1.29 x10 <sup>7</sup> a	1.20 x10 <sup>7</sup> a	12.419	<0.05

**Table S4: continued.**

Sampling date	26.05.20	30.06.20	14.07.20	25.08.20	15.09.20	ANOVA	
						F	$\rho$
<b><i>nirK</i></b>							
ZI-ZN	2.33 x10 <sup>6</sup>	2.08x10 <sup>6</sup>	1.28x10 <sup>6</sup>	2.15x10 <sup>6</sup>	2.15x10 <sup>6</sup>	4.327	0.028
SI-ZN	7.28 x10 <sup>5</sup> a	2.06 x10 <sup>6</sup> c	9.04 x10 <sup>5</sup> a	2.28x10 <sup>6</sup> bc	1.48x10 <sup>6</sup> ab	12.256	<0.05
DI-ZN	1.19 x10 <sup>6</sup>	2.09x10 <sup>6</sup>	1.27x10 <sup>6</sup>	2.05x10 <sup>6</sup>	1.96x10 <sup>6</sup>	3.753	0.041
ZI-N	1.31 x10 <sup>6</sup>	2.04x10 <sup>5</sup>	6.14x10 <sup>5</sup>	1.16x10 <sup>6</sup>	2.17x10 <sup>6</sup>	4.327	0.041
SI-N	1.29 x10 <sup>6</sup> a	1.74 x10 <sup>6</sup> b	1.42x10 <sup>6</sup> a	2.07x10 <sup>6</sup> b	1.59x10 <sup>6</sup> a	17.323	<0.05
DI-N	1.22x10 <sup>6</sup> ac	2.32x10 <sup>6</sup> bd	1.02x10 <sup>6</sup> ab	1.92x10 <sup>6</sup> cd	1.31x10 <sup>6</sup> abcd	22.651	<0.05
F	1.37x10 <sup>6</sup> a	2.01x10 <sup>6</sup> c	1.05x10 <sup>6</sup> a	2.38x10 <sup>6</sup> bc	1.68x10 <sup>6</sup> ab	23.697	<0.05
F-ZC	1.65x10 <sup>6</sup> ab	1.94x10 <sup>6</sup> b	7.94x10 <sup>5</sup> a	2.18x10 <sup>6</sup> b	1.06x10 <sup>6</sup> ab	5.822	<0.05
<b><i>nirS</i></b>							
ZI-ZN	1.75x10 <sup>5</sup> ab	1.34x10 <sup>5</sup> a	2.18x10 <sup>5</sup> ab	2.33x10 <sup>5</sup> b	2.47x10 <sup>5</sup> b	4.667	<0.05
SI-ZN	1.87x10 <sup>5</sup> ab	1.43x10 <sup>5</sup> a	1.40x10 <sup>5</sup> a	2.12x10 <sup>5</sup> ab	2.58x10 <sup>5</sup> b	8.793	<0.05
DI-ZN	1.50x10 <sup>5</sup>	2.83x10 <sup>5</sup>	2.18x10 <sup>5</sup>	2.36x10 <sup>5</sup>	2.19x10 <sup>5</sup>	2.303	0.130
ZI-N	1.97x10 <sup>5</sup> ab	2.23x10 <sup>5</sup> b	1.24x10 <sup>5</sup> a	1.71x10 <sup>5</sup> ab	2.26x10 <sup>6</sup> ab	4.259	<0.05
SI-N	1.61x10 <sup>5</sup> a	2.56x10 <sup>5</sup> ab	2.35x10 <sup>5</sup> ab	2.25x10 <sup>5</sup> ab	3.19x10 <sup>6</sup> b	5.233	<0.05
DI-N	1.92x10 <sup>5</sup>	2.33x10 <sup>5</sup>	1.72x10 <sup>5</sup>	1.92x10 <sup>5</sup>	2.43x10 <sup>5</sup>	3.403	0.053
F	2.60x10 <sup>5</sup> ab	1.81x10 <sup>5</sup> a	1.87x10 <sup>5</sup> a	2.23x10 <sup>5</sup> a	3.32x10 <sup>6</sup> b	8.030	<0.05
F-ZC	2.49x10 <sup>5</sup> b	1.01x10 <sup>5</sup> a	1.69x10 <sup>5</sup> ab	2.01x10 <sup>5</sup> ab	1.93x10 <sup>5</sup> ab	3.408	<0.05
<b><i>nosZ</i></b>							
ZI-ZN	1.20x10 <sup>5</sup> a	1.94x10 <sup>5</sup> b	1.89x10 <sup>5</sup> b	1.07x10 <sup>5</sup> ab	1.19x10 <sup>5</sup> ab	4.956	<0.05
SI-ZN	8.41x10 <sup>4</sup> a	6.38x10 <sup>4</sup> a	1.33x10 <sup>4</sup> b	8.46x10 <sup>4</sup> a	1.67x10 <sup>5</sup> b	13.263	<0.05
DI-ZN	2.66x10 <sup>5</sup> a	2.42x10 <sup>5</sup> a	1.47x10 <sup>5</sup> a	1.67x10 <sup>5</sup> b	1.20x10 <sup>5</sup> a	48.17	<0.05
ZI-N	1.63 x10 <sup>5</sup> a	1.83x10 <sup>5</sup> a	9.19x10 <sup>4</sup> a	1.08x10 <sup>6</sup> b	1.30x10 <sup>5</sup> a	37.702	<0.05
SI-N	2.91 x10 <sup>5</sup> a	2.07 x10 <sup>5</sup> a	1.42x10 <sup>5</sup> a	1.61x10 <sup>6</sup> b	1.65x10 <sup>5</sup> a	41.078	<0.05
DI-N	4.53x10 <sup>5</sup> a	2.05x10 <sup>5</sup> a	1.18x10 <sup>5</sup> a	1.20x10 <sup>6</sup> b	1.66x10 <sup>5</sup> a	100.329	<0.05
F	1.08x10 <sup>5</sup> a	8.15x10 <sup>5</sup> a	1.65x10 <sup>5</sup> a	1.03x10 <sup>6</sup> b	1.76x10 <sup>5</sup> a	49.16	<0.05
F-ZC	1.08x10 <sup>5</sup>	9.80x10 <sup>4</sup>	1.65x10 <sup>5</sup>	9.80x10 <sup>5</sup>	1.33x10 <sup>5</sup>	2.650	0.096



**Table S5: Pearson's correlations for the detection of time-independent relationships among the investigated gene copy numbers per gram soil and between the investigated genes and the main environmental factors for treatment ZI-ZN (zero irrigation without (zero) N application) of the ridge (0-10cm). *amoA* = gene encoding ammonium monooxygenase, *nxB* = gene encoding nitrite oxidoreductase, *narG* = gene encoding nitrate reductase, *nirK/nirS* = gene encoding nitrite reductase and *nosZ* = gene encoding nitrous oxide (N<sub>2</sub>O) reductase, N<sub>2</sub>O = nitrous oxide, WFPS = water filled pore space, Temp = soil temperature, NH<sub>4</sub><sup>+</sup> = ammonium, NO<sub>2</sub><sup>-</sup> = nitrite, NO<sub>3</sub><sup>-</sup> = nitrate. Values with \*, \*\*, \*\*\* indicate significance at  $p < 0.05, 0.01, 0.001$ .**

<b>ZI-ZN</b>	<i>amoA</i>	<i>nxB</i>	<i>narG</i>	<i>nirK</i>	<i>nirS</i>	<i>nosZ</i>	N <sub>2</sub> O	WFPS	Temp	NH <sub>4</sub> <sup>+</sup>	NO <sub>2</sub> <sup>-</sup>	NO <sub>3</sub> <sup>-</sup>
<i>amoA</i>	-											
<i>nxB</i>	-0.48	-										
<i>narG</i>	0.43	0.39	-									
<i>nirK</i>	0.57	0.28	0.46	-								
<i>nirS</i>	0.09	-0.76	-0.68	-0.58	-							
<i>nosZ</i>	-0.72	0.81	0.31	-0.27	-0.55	-						
N <sub>2</sub> O	-0.42	-0.37	-0.39	-0.98	0.40	0.18	-					
WFPS	0.11	0.27	0.76	0.22	-0.74	0.39	-0.22	-				
Temp	-0.55	-0.16	-0.94	-0.51	0.65	-0.09	0.44	-0.86	-			
NH <sub>4</sub>	0.93	-0.22	0.70	0.68	-0.27	-0.46	-0.56	0.44	-0.82	-		
NO <sub>2</sub> <sup>-</sup>	0.02	-0.78	-0.33	-0.59	0.49	-0.33	0.61	0.13	0.08	-0.08	-	
NO <sub>3</sub> <sup>-</sup>	0.86	-0.80	0.19	0.23	0.29	-0.80	-0.10	0.17	-0.43	0.76	0.52	-

**Table S6: Pearson's correlations for the detection of time-independent relationships among the investigated gene copy numbers per gram soil and between the investigated genes and the main environmental factors for treatment SI-ZN (sprinkler irrigation without (zero) N application) of the ridge (0-10cm). *amoA* = gene encoding ammonium monooxygenase, *nxB* = gene encoding nitrite oxidoreductase, *narG* = gene encoding nitrate reductase, *nirK/nirS* = gene encoding nitrite reductase and *nosZ* = gene encoding nitrous oxide (N<sub>2</sub>O) reductase, N<sub>2</sub>O = nitrous oxide, WFPS = water filled pore space, Temp = soil temperature, NH<sub>4</sub><sup>+</sup> = ammonium, NO<sub>2</sub><sup>-</sup> = nitrite, NO<sub>3</sub><sup>-</sup> = nitrate. Values with \*, \*\*, \*\*\* indicate significance at  $p < 0.05, 0.01, 0.001$ .**

SI-ZN	<i>amoA</i>	<i>nxB</i>	<i>narG</i>	<i>nirK</i>	<i>nirS</i>	<i>nosZ</i>	N <sub>2</sub> O	WFPS	Temp	NH <sub>4</sub> <sup>+</sup>	NO <sub>2</sub> <sup>-</sup>	NO <sub>3</sub> <sup>-</sup>
<i>amoA</i>	-											
<i>nxB</i>	-0.58	-										
<i>narG</i>	0.59	-0.36	-									
<i>nirK</i>	-0.64	0.88	-0.53	-								
<i>nirS</i>	0.04	0.56	-0.10	0.16	-							
<i>nosZ</i>	-0.22	-0.02	-0.19	-0.35	0.52	-						
N <sub>2</sub> O	0.32	-0.84	0.41	-0.57	-0.90	-0.37	-					
WFPS	0.22	-0.10	0.77	-0.02	-0.46	-0.66	0.49	-				
Temp	-0.84	0.58	-0.87	0.58	0.30	0.46	-0.60	-0.70	-			
NH <sub>4</sub>	0.79	0.03	0.37	-0.08	0.42	-0.36	-0.21	0.16	-0.56	-		
NO <sub>2</sub> <sup>-</sup>	-0.80	0.63	-0.55	0.44	0.50	0.67	-0.69	-0.55	0.89	-0.55	-	
NO <sub>3</sub> <sup>-</sup>	0.97	-0.41	0.60	-0.59	0.29	-0.09	0.10	0.15	-0.75	0.86	-0.65	-

**Table S7: Pearson's correlations for the detection of time-independent relationships among the investigated gene copy numbers per gram soil and between the investigated genes and the main environmental factors for treatment DI-ZN (drip irrigation without (zero) N application) of the ridge (0-10cm). *amoA* = gene encoding ammonium monooxygenase, *nxB* = gene encoding nitrite oxidoreductase, *narG* = gene encoding nitrate reductase, *nirK/nirS* = gene encoding nitrite reductase and *nosZ* = gene encoding nitrous oxide (N<sub>2</sub>O) reductase, N<sub>2</sub>O = nitrous oxide, WFPS = water filled pore space, Temp = soil temperature, NH<sub>4</sub><sup>+</sup> = ammonium, NO<sub>2</sub><sup>-</sup> = nitrite, NO<sub>3</sub><sup>-</sup> = nitrate. Values with \*, \*\*, \*\*\* indicate significance at  $p < 0.05, 0.01, 0.001$ .**

DI-ZN	<i>amoA</i>	<i>nxB</i>	<i>narG</i>	<i>nirK</i>	<i>nirS</i>	<i>nosZ</i>	N <sub>2</sub> O	WFPS	Temp	NH <sub>4</sub> <sup>+</sup>	NO <sub>2</sub> <sup>-</sup>	NO <sub>3</sub> <sup>-</sup>
<i>amoA</i>	-											
<i>nxB</i>	-0.24	-										
<i>narG</i>	0.56	-0.04	-									
<i>nirK</i>	-0.73	0.59	-0.06	-								
<i>nirS</i>	-0.20	0.47	0.55	0.79	-							
<i>nosZ</i>	-0.39	0.83	-0.15	0.41	0.15	-						
N <sub>2</sub> O	-0.23	0.61	0.40	0.44	0.48	0.80	-					
WFPS	-0.22	-0.67	0.11	-0.20	-0.23	-0.22	0.11	-				
Temp	-0.08	0.87	0.05	0.61	0.63	0.45	0.28	-0.87	-			
NH <sub>4</sub>	0.31	-0.47	0.81	-0.18	0.26	-0.30	0.31	0.67	-0.49	-		
NO <sub>2</sub> <sup>-</sup>	-0.23	-0.20	-0.93	-0.28	-0.75	-0.12	-0.66	-0.13	-0.20	-0.75	-	
NO <sub>3</sub> <sup>-</sup>	-0.40	0.28	-0.61	-0.09	-0.55	0.70	0.31	0.12	-0.16	-0.42	0.48	-

**Table S8: Pearson's correlations for the detection of time-independent relationships among the investigated gene copy numbers per gram soil and between the investigated genes and the main environmental factors for treatment ZI-N (zero irrigation with N application) of the ridge (0-10cm). *amoA* = gene encoding ammonium monooxygenase, *nxrB* = gene encoding nitrite oxidoreductase, *narG* = gene encoding nitrate reductase, *nirK/nirS* = gene encoding nitrite reductase and *nosZ* = gene encoding nitrous oxide (N<sub>2</sub>O) reductase, N<sub>2</sub>O = nitrous oxide, WFPS = water filled pore space, Temp = soil temperature, NH<sub>4</sub><sup>+</sup> = ammonium, NO<sub>2</sub><sup>-</sup> = nitrite, NO<sub>3</sub><sup>-</sup> = nitrate. Values with \*, \*\*, \*\*\* indicate significance at  $p < 0.05, 0.01, 0.001$ .**

ZI-N	<i>amoA</i>	<i>nxrB</i>	<i>narG</i>	<i>nirK</i>	<i>nirS</i>	<i>nosZ</i>	N <sub>2</sub> O	WFPS	Temp	NH <sub>4</sub> <sup>+</sup>	NO <sub>2</sub> <sup>-</sup>	NO <sub>3</sub> <sup>-</sup>
<i>amoA</i>	-											
<i>nxrB</i>	-0.45	-										
<i>narG</i>	0.12	-0.92	-									
<i>nirK</i>	-0.97	0.50	-0.19	-								
<i>nirS</i>	-0.89	0.53	-0.21	0.96	-							
<i>nosZ</i>	0.05	0.34	-0.24	-0.21	-0.16	-						
N <sub>2</sub> O	-0.29	-0.53	0.81	0.25	0.32	-0.10	-					
WFPS	-0.33	-0.36	0.53	0.45	0.53	-0.66	0.74	-				
Temp	-0.22	0.16	-0.17	0.02	-0.21	0.37	-0.39	-0.68	-			
NH <sub>4</sub>	0.44	-0.84	0.67	-0.56	-0.71	-0.22	0.13	-0.09	0.36	-		
NO <sub>2</sub> <sup>-</sup>	-0.28	0.03	-0.14	0.36	0.19	-0.79	-0.31	0.22	0.20	0.18	-	
NO <sub>3</sub> <sup>-</sup>	-0.04	0.21	-0.36	-0.09	-0.32	0.13	-0.68	-0.72	0.91	0.35	0.44	-

**Table S9: Pearson's correlations for the detection of time-independent relationships among the investigated gene copy numbers per gram soil and between the investigated genes and the main environmental factors for treatment SI-N (sprinkler irrigation with N application) of the ridge (0-10cm). *amoA* = gene encoding ammonium monooxygenase, *nxB* = gene encoding nitrite oxidoreductase, *narG* = gene encoding nitrate reductase, *nirK/nirS* = gene encoding nitrite reductase and *nosZ* = gene encoding nitrous oxide (N<sub>2</sub>O) reductase, N<sub>2</sub>O = nitrous oxide, WFPS = water filled pore space, Temp = soil temperature, NH<sub>4</sub><sup>+</sup> = ammonium, NO<sub>2</sub><sup>-</sup> = nitrite, NO<sub>3</sub><sup>-</sup> = nitrate. Values with \*, \*\*, \*\*\* indicate significance at *p* < 0.05, 0.01, 0.001.**

SI-N	<i>amoA</i>	<i>nxB</i>	<i>narG</i>	<i>nirK</i>	<i>nirS</i>	<i>nosZ</i>	N <sub>2</sub> O	WFPS	Temp	NH <sub>4</sub> <sup>+</sup>	NO <sub>2</sub> <sup>-</sup>	NO <sub>3</sub> <sup>-</sup>
<i>amoA</i>	-											
<i>nxB</i>	0.11	-										
<i>narG</i>	0.62	-0.22	-									
<i>nirK</i>	-0.41	0.62	-0.06	-								
<i>nirS</i>	-0.16	0.48	-0.02	0.29	-							
<i>nosZ</i>	-0.22	0.61	-0.27	0.81	-0.20	-						
N <sub>2</sub> O	0.51	-0.60	0.90	-0.39	-0.18	-0.55	-					
WFPS	-0.49	-0.89	0.03	-0.22	-0.45	-0.27	0.36	-				
Temp	0.16	0.83	0.21	0.64	0.75	0.33	-0.17	-0.75	-			
NH <sub>4</sub>	0.89	-0.19	0.52	-0.54	-0.58	-0.17	0.53	-0.16	-0.26	-		
NO <sub>2</sub> <sup>-</sup>	-0.02	0.90	-0.48	0.36	0.62	0.33	-0.74	-0.85	0.68	-0.34	-	
NO <sub>3</sub> <sup>-</sup>	0.19	0.86	-0.39	0.41	0.02	0.71	-0.69	-0.79	0.46	0.09	0.76	-

**Table S10: Pearson's correlations for the detection of time-independent relationships among the investigated gene copy numbers per gram soil and between the investigated genes and the main environmental factors for treatment DI-N (drip irrigation with N application) of the ridge (0-10cm). *amoA* = gene encoding ammonium monooxygenase, *nxB* = gene encoding nitrite oxidoreductase, *narG* = gene encoding nitrate reductase, *nirK/nirS* = gene encoding nitrite reductase and *nosZ* = gene encoding nitrous oxide (N<sub>2</sub>O) reductase, N<sub>2</sub>O = nitrous oxide, WFPS = water filled pore space, Temp = soil temperature, NH<sub>4</sub><sup>+</sup> = ammonium, NO<sub>2</sub><sup>-</sup> = nitrite, NO<sub>3</sub><sup>-</sup> = nitrate. Values with \*, \*\*, \*\*\* indicate significance at *p* < 0.05, 0.01, 0.001.**

<b>DI-N</b>	<i>amoA</i>	<i>nxB</i>	<i>narG</i>	<i>nirK</i>	<i>nirS</i>	<i>nosZ</i>	N <sub>2</sub> O	WFPS	Temp	NH <sub>4</sub> <sup>+</sup>	NO <sub>2</sub> <sup>-</sup>	NO <sub>3</sub> <sup>-</sup>
<i>amoA</i>	-											
<i>nxB</i>	-0.46	-										
<i>narG</i>	0.50	-0.45	-									
<i>nirK</i>	-0.66	0.28	0.25	-								
<i>nirS</i>	-0.69	0.47	-0.19	0.44	-							
<i>nosZ</i>	-0.39	0.42	-0.42	0.35	-0.29	-						
N <sub>2</sub> O	0.83	-0.49	0.88	-0.23	-0.38	-0.58	-					
WFPS	-0.37	-0.60	0.19	0.33	0.32	-0.35	-0.06	-				
Temp	0.07	0.83	0.00	0.09	0.18	0.18	0.07	-0.82	-			
NH <sub>4</sub>	-0.12	-0.58	-0.31	-0.12	-0.47	0.36	-0.34	0.44	-0.82	-		
NO <sub>2</sub> <sup>-</sup>	0.22	0.73	-0.02	-0.16	0.21	-0.08	0.17	-0.81	0.95	-0.87	-	
NO <sub>3</sub> <sup>-</sup>	0.37	0.40	0.01	-0.09	-0.60	0.61	0.12	-0.87	0.63	-0.17	0.50	-

**Table S11: Pearson's correlations for the detection of time-independent relationships among the investigated gene copy numbers per gram soil and between the investigated genes and the main environmental factors for treatment F (fertigation) of the ridge (0-10cm). *amoA* = gene encoding ammonium monooxygenase, *nxB* = gene encoding nitrite oxidoreductase, *narG* = gene encoding nitrate reductase, *nirK/nirS* = gene encoding nitrite reductase and *nosZ* = gene encoding nitrous oxide (N<sub>2</sub>O) reductase, N<sub>2</sub>O = nitrous oxide, WFPS = water filled pore space, Temp = soil temperature, NH<sub>4</sub><sup>+</sup> = ammonium, NO<sub>2</sub><sup>-</sup> = nitrite, NO<sub>3</sub><sup>-</sup> = nitrate. Values with \*, \*\*, \*\*\* indicate significance at *p* < 0.05, 0.01, 0.001.**

<b>F</b>	<i>amoA</i>	<i>nxB</i>	<i>narG</i>	<i>nirK</i>	<i>nirS</i>	<i>nosZ</i>	N <sub>2</sub> O	WFPS	Temp	NH <sub>4</sub> <sup>+</sup>	NO <sub>2</sub> <sup>-</sup>	NO <sub>3</sub> <sup>-</sup>
<i>amoA</i>	-											
<i>nxB</i>	-0.78	-										
<i>narG</i>	0.81	-0.73	-									
<i>nirK</i>	-0.54	0.70	-0.31	-								
<i>nirS</i>	0.29	0.19	0.12	-0.29	-							
<i>nosZ</i>	-0.07	-0.06	-0.19	-0.73	0.50	-						
N <sub>2</sub> O	-0.17	-0.16	0.33	0.44	-0.73	-0.58	-					
WFPS	0.37	-0.65	0.80	-0.21	-0.29	-0.12	0.71	-				
Temp	-0.85	0.76	-0.98	0.25	0.00	0.34	-0.36	-0.75	-			
NH <sub>4</sub>	0.64	-0.72	0.85	-0.04	-0.38	-0.57	0.64	0.79	-0.92	-		
NO <sub>2</sub> <sup>-</sup>	-0.34	0.52	-0.63	-0.23	0.64	0.73	-0.83	-0.72	0.72	-0.93	-	
NO <sub>3</sub> <sup>-</sup>	-0.20	-0.03	-0.64	-0.34	-0.26	0.32	-0.46	-0.57	0.56	-0.48	0.41	-

**Table S12: Pearson's correlations for the detection of time-independent relationships among the investigated gene copy numbers per gram soil and between the investigated genes and the main environmental factors for treatment F-ZC (fertigation without (zero) crops) of the ridge (0-10cm). *amoA* = gene encoding ammonium monooxygenase, *nxrB* = gene encoding nitrite oxidoreductase, *narG* = gene encoding nitrate reductase, *nirK/nirS* = gene encoding nitrite reductase and *nosZ* = gene encoding nitrous oxide (N<sub>2</sub>O) reductase, N<sub>2</sub>O = nitrous oxide, WFPS = water filled pore space, Temp = soil temperature, NH<sub>4</sub><sup>+</sup> = ammonium, NO<sub>2</sub><sup>-</sup> = nitrite, NO<sub>3</sub><sup>-</sup> = nitrate. Values with \*, \*\*, \*\*\* indicate significance at *p* < 0.05, 0.01, 0.001.**

<b>F-ZC</b>	<i>amoA</i>	<i>nxrB</i>	<i>narG</i>	<i>nirK</i>	<i>nirS</i>	<i>nosZ</i>	N <sub>2</sub> O	WFPS	Temp	NH <sub>4</sub> <sup>+</sup>	NO <sub>2</sub> <sup>-</sup>	NO <sub>3</sub> <sup>-</sup>
<i>amoA</i>	-											
<i>nxrB</i>	0.90	-										
<i>narG</i>	0.84	0.86	-									
<i>nirK</i>	0.12	0.38	0.12	-								
<i>nirS</i>	0.84	0.55	0.46	-0.07	-							
<i>nosZ</i>	-0.15	-0.33	-0.21	-0.95	0.02	-						
N <sub>2</sub> O	-0.09	0.12	0.21	-0.41	-0.44	0.52	-					
WFPS	0.09	0.28	0.51	-0.32	-0.35	0.33	0.92	-				
Temp	-0.82	-0.73	-0.96	0.09	-0.55	0.05	-0.14	-0.45	-			
NH <sub>4</sub>	0.92	0.84	0.71	0.44	0.81	-0.48	-0.41	-0.21	-0.67	-		
NO <sub>2</sub> <sup>-</sup>	-0.35	-0.35	-0.61	-0.45	-0.12	0.68	0.32	-0.06	0.61	-0.50	-	
NO <sub>3</sub> <sup>-</sup>	-0.62	-0.77	-0.80	-0.66	-0.22	0.74	0.10	-0.21	0.67	-0.72	0.83	-



**Table S13: Time dependent mixed effect model with `N<sub>2</sub>O fluxes` as response variable and `week` and `gene copy numbers per gram soil` and their interactions as explanatory variables. Model includes correction exponent due to the uneven time spacing between sampling dates. Correlation coefficients derived from two-way ANOVA for each gene for each treatment are shown. *amoA* = gene encoding ammonium monooxygenase, *nxB* = gene encoding nitrite oxidoreductase, *narG* = gene encoding nitrate reductase, *nirK/nirS* = gene encoding nitrite reductase and *nosZ* = gene encoding nitrous oxide (N<sub>2</sub>O) reductase. Values with \*, \*\*, \*\*\* indicate significance at  $p < 0.05, 0.01, 0.001$ .**

Treatment		ZI-ZN (zero irrigation without (zero) N application)											
Gene	<i>amoA</i>		<i>nxB</i>		<i>narG</i>		<i>nirK</i>		<i>nirS</i>		<i>nosZ</i>		
	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	
Week	26.27	0.0009***	41.58	1.6 e-06***	14.3	0.074	40.91	2.17 e-06***	39.48	4 -06***	43.52	6.99 e-7***	
Gene	0.144	0.995	3.74	0.053	1.25	0.263	3.1	0.078	0.31	0.577	3.48	0.062	
Interaction	3.99	0.858	7.94	0.439	7.67	0.466	6.56	0.584	10.09	0.258	14.96	0.059	
Treatment		SI-ZN (sprinkler irrigation without (zero) N application)											
Gene	<i>amoA</i>		<i>nxB</i>		<i>narG</i>		<i>nirK</i>		<i>nirS</i>		<i>nosZ</i>		
	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	
Week	40.14	3.01 e-06***	34.56	3.21e-05***	34.72	3.0 e-05***	45.9	2.49 e-07***	22.14	0.005**	75.64	3.68e-13***	
Gene	0.05	0.800	0.05	0.830	0.01	0.919	2.87	0.090	0.22	0.636	5.14	0.023*	
Interaction	9.61	0.293	8.2	0.414	7.94	0.540	8.0	0.433	6.58	0.583	18.20	0.019*	
Treatment		DI-ZN (drip irrigation without (zero) N application)											
Gene	<i>amoA</i>		<i>nxB</i>		<i>narG</i>		<i>nirK</i>		<i>nirS</i>		<i>nosZ</i>		
	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	
Week	25.06	0.0015**	124.68	<2.2e-16***	43.15	8.22e-07***	64.1	7.28e-11***	36.3	1.55e-05***	68.85	8.3e-12***	
Gene	0.55	0.458	0.001	0.921	0.0028	0.958	1.1	0.293	1.66	0.198	0.2	0.66	
Interaction	2.15	0.976	743.56	6.Z-07***	8.68	0.370	26.76	0.0008***	17.28	0.03*	32.74	6.86e-05***	

**Table S13: continued.**

Treatment		<b>ZI-N (zero irrigation with N application)</b>											
Gene	<i>amoA</i>		<i>nxrB</i>		<i>narG</i>		<i>nirK</i>		<i>nirS</i>		<i>nosZ</i>		
	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	
Week	40.14	3.01 e-06 <sup>***</sup>	34.56	3.21e-05 <sup>***</sup>	34.72	3.0 e-05 <sup>***</sup>	45.9	2.49 e-07 <sup>***</sup>	22.14	0.005 <sup>**</sup>	75.64	3.68e-13 <sup>***</sup>	
Gene	0.05	0.800	0.05	0.830	0.01	0.919	2.87	0.090	0.22	0.636	5.14	0.023 <sup>*</sup>	
Interaction	9.61	0.293	8.2	0.414	7.94	0.540	8.0	0.433	6.58	0.583	18.20	0.019 <sup>*</sup>	
Treatment		<b>SI-N (sprinkler irrigation with N application)</b>											
Gene	<i>amoA</i>		<i>nxrB</i>		<i>narG</i>		<i>nirK</i>		<i>nirS</i>		<i>nosZ</i>		
	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	
Week	25.06	0.0015 <sup>**</sup>	124.68	<2.2e-16 <sup>***</sup>	43.15	8.22e-07 <sup>***</sup>	64.1	7.28e-11 <sup>***</sup>	36.3	1.55e-05 <sup>***</sup>	68.85	8.3e-12 <sup>***</sup>	
Gene	0.55	0.458	0.001	0.921	0.0028	0.958	1.1	0.293	1.66	0.198	0.2	0.66	
Interaction	2.15	0.976	743.56	6.87e-07 <sup>***</sup>	8.68	0.370	26.76	0.0008 <sup>***</sup>	17.28	0.03 <sup>*</sup>	32.74	6.86e-05 <sup>***</sup>	
Treatment		<b>DI-N (drip irrigation with N application)</b>											
Gene	<i>amoA</i>		<i>nxrB</i>		<i>narG</i>		<i>nirK</i>		<i>nirS</i>		<i>nosZ</i>		
	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	
Week	26.27	0.0009 <sup>***</sup>	41.58	1.6 e-06 <sup>***</sup>	14.3	0.074	40.91	2.17 e-06 <sup>***</sup>	39.48	4 -06 <sup>***</sup>	43.52	6.99 e-7 <sup>***</sup>	
Gene	0.144	0.995	3.74	0.053	1.25	0.263	3.1	0.078	0.31	0.577	3.48	0.062	
Interaction	3.99	0.858	7.94	0.439	7.67	0.466	6.56	0.584	10.09	0.258	14.96	0.059	

**Table S13: continued.**

Treatment		F (fertigation)											
Gene	<i>amoA</i>		<i>nxB</i>		<i>narG</i>		<i>nirK</i>		<i>nirS</i>		<i>nosZ</i>		
	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	
Week	26.27	0.0009***	41.58	1.6 e-06***	14.3	0.074	40.91	2.17 e-06***	39.48	4 -06***	43.52	6.99 e-7***	
Gene	0.144	0.995	3.74	0.053	1.25	0.263	3.1	0.078	0.31	0.577	3.48	0.062	
Interaction	3.99	0.858	7.94	0.439	7.67	0.466	6.56	0.584	10.09	0.258	14.96	0.059	

  

Treatment		F-ZC (fertigation without (zero) crops)											
Gene	<i>amoA</i>		<i>nxB</i>		<i>narG</i>		<i>nirK</i>		<i>nirS</i>		<i>nosZ</i>		
	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	Chisq	<i>p</i>	
Week	40.14	3.01 e-06***	34.56	3.21e-05***	34.72	3.0 e-05***	45.9	2.49 e-07***	22.14	0.005**	75.64	3.68e-13***	
Gene	0.05	0.800	0.05	0.830	0.01	0.919	2.87	0.090	0.22	0.636	5.14	0.023*	
Interaction	9.61	0.293	8.2	0.414	7.94	0.540	8.0	0.433	6.58	0.583	18.20	0.019*	



Figure S1: Determined quantities of log transformed gene copy numbers per gram soil with standard deviation of *amoA* (gene encoding ammonium monooxygenase, green), *nxrB* (gene encoding nitrite oxidoreductase, orange), *narG* (gene encoding nitrate reductase, purple), *nirK* (gene encoding nitrite reductase, pink), *nirS* (gene encoding nitrite reductase, light green), *nosZ* (gene encoding N<sub>2</sub>O reductase, yellow) for each treatment: ZI-ZN (no (zero) irrigation without (zero) nitrogen (N) fertilizer), ZI-N (no (zero) irrigation with broadcasted N fertilizer), SI-ZN (sprinkler irrigation without (zero) N fertilizer), SI-N (sprinkler irrigation with broadcasted N fertilizer), DI-ZN (drip irrigation without (zero) N fertilizer), DI-N (drip irrigation with broadcasted N fertilizer), F (fertigation), F-ZC (fertigation without (zero) crops), over the cropping season 2020 (n = 162 per treatment and gene).

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