Supplementary Materials

Table S1. Carbon and nitrogen inputs expressed as the volume of Raw (RDE) or Lagoon Dairy effluent (LDE) applied to fescue pots (mean n = 3 ± S.E). Different letters beside the numbers indicate they are significantly different at $p < 0.05$.

Parameter	**Application dates**							
L pot^{-1} applied	September		November		January		March	
	RDE	**LDE**	**RDE**	**LDE**	**RDE**	**LDE**	**RDE**	**LDE**
Organic C mg	339.3± 38.9 de	126.8± 6.4 ab	365.1± 31.4 d	118.2± 41.9 a	222.5± 10.5 bc	410.0± 44.6 d	262.1± 30.6 cd	139.6± 33.1 ab
Organic N mg	56.9± 0.7 a	36.6± 5.4 a	57.3± 1.0 a	53.4± 8.6 a	61.3± 1.4 a	61.9± 7.5 a	58.9± 1.6 a	61.9± 5.1 a
NH_4^+-N mg	25.1± 0.7 ab	44.3± 6.7 c	22.6± 2.6 ab	26.8± 1.2 b	18.9± 0.3 a	17.6± 0.3 a	21.2± 1.7 ab	18.2± 0.2 a

Table S2. Soil organic carbon (SOC), the sum N-mineralization and Yield-scaled N_2O emission at the last application of Raw (RDE) or Lagoon Dairy effluent (LDE), urea, or non-amended control (mean n = 3 ± S.E). Different letters beside the numbers indicate they are significantly different at $p < 0.05$. ns: no significantly different.

Treatment	**SOC (%)**	**Sum N_min (g pot^{-1})**	**Yield-scaled N_2O emission for the last application (mg N-N_2O g^{-1} forage DM)**
Control	3.0± 0.1	1.1 ± 0.1 b	1.1 ± 0.8
LDE	3.1± 0.1	1.2 ± 0.0 ab	2.8 ± 1.3
RDE	3.1± 0.1	1.4 ± 0.2 a	5.1 ± 1.0
Urea	3.0± 0.1	1.6 ± 0.4 ab	1.8 ± 1.5
	ns		ns

Table S3. Cumulative nitrogen transformations in soil with fescue pasture with the application of Raw (RDE) or Lagoon Dairy effluent (LDE), urea, or non-amended control. Cumulative production after 45 days of each application date is presented (mean n = 3 ± S.E); except for N_2O emissions after 20 days . Different letters beside the numbers indicate significant differences at $p < 0.05$ for each application date.

		Cumulative production			
	Treatment	Application date			
		Sep.	Nov.	Jan.	Mar.
N_2O emissions (kg N ha^{-1})	Control	0.3± 0.3 **a**	n.d	2.7± 2.1 **a**	0.2± 0.1 **a**
	LDE	7.9± 7.6 **a**	n.d	7.7± 7.4 **a**	0.4± 0.1 **a**
	RDE	9.1± 8.9 **a**	n.d	6.6± 3.5 **a**	1.3± 0.9 **b**
	Urea	0.4± 0.4 **a**	n.d	6.4± 1.7 **a**	0.4± 0.3 **a**
Potential mineralizable N (mg N g^{-1})	Control	164.3± 4.3 **a**	153.6± 4.5 **a**	194.6± 2.8 **a**	94.0± 2.1 **a**
	LDE	166.1± 21.2 **a**	165.8± 2.2 **a**	200.2± 8.1 **a**	128.4± 0.6 **a**
	RDE	167.2± 6.0 **a**	179.3± 3.7 **a**	204.8± 9.9 **a**	198.7± 21.3 **b**
	Urea	130.5± 11.1 **a**	166.6± 6.4 **a**	219.0± 34.9 **a**	104.3± 10.4 **a**
Potential nitrification activity (mg N g^{-1})	Control	406.4± 12.0 **a**	547.5± 42.4 **a**	793.9± 47.8 **ab**	763.6± 101.1 **ab**
	LDE	424.6± 58.4 **a**	591.1± 59.7 **a**	999.1± 61.1 **b**	970.1± 67.0 **b**
	RDE	413.9± 38.5 **a**	613.8± 82.1 **a**	890.5± 48.1 a**b**	963.1± 34.4 **b**
	Urea	336.2± 14.4 **a**	419.1± 49.5 **a**	709.0± 75.7 **a**	664.6± 55.1 **a**
Inorganic N (mg N g^{-1})	Control	1954.9± 108.8 **a**	2433.3± 178.6 **a**	728.5± 47.7 **a**	913.4± 173.1 **a**
	LDE	3399.6± 127.5 **c**	2650.5± 202.5 a**b**	842.1± 59.0 **a**	1027.0± 20.8 **a**
	RDE	2902.4± 219.6 **b**	3218.4± 161.6 **b**	1150.0± 83.7 **a**	1037.0± 54.1 **a**
	Urea	3398.6± 416.8 **c**	2977.5± 168.1 **b**	797.5± 31.7 **a**	1042.3± 60.8 **a**

n.d: not determined

Table S4. Pearson correlations among soil inorganic N ((NH_4^+ + NO_3^-)-N, potential nitrification activity (PNA), potentially mineralizable N (PMN) and N_2O taken from the third and fourth dairy effluent applications.

	PMN	**PNA**	**NH_4^+**	**NO_3^-**	**N_2O**
PMN	1				
PNA	0,45*	1			
NH_4^+	-0,16	-0,32	1		
NO_3^-	-0,08	-0,35	0,91**	1	
N_20	0,04	-0,28	0,66**	0,76**	1

*Significant at $p < 0.05$; **significant at $p < 0.0005$