



Table S1. Data used for the calculations of inputs and outputs of silage maize cultivation on a dry sandy soil.

Year	Slurry application		Fertilizer application		N release from ploughed grassland	N deposition	Manure composition, g/kg			Dry matter yield	Compostion harvested crop	
	kg N/ha	kg P ₂ O ₅ /ha	kg N/ha	kg P ₂ O ₅ /ha	kg N/ha/yr	kg N/ha	N, g/kg	P ₂ O ₅ , g/kg	TAN, g/kg	kg/ha (x1000)	N, g/kg dm	P, g/kg dm
1985	500	177	55	50	0	40	4.8	1.7	2.3	11.3	13.6	2.5
1986	500	177	55	50	2	40	4.8	1.7	2.3	13.5	13.6	2.5
1987	482	171	55	50	4	40	4.8	1.7	2.3	11.9	13.6	2.5
1988	463	164	55	50	6	40	4.8	1.7	2.3	12.7	13.6	2.5
1989	445	158	55	50	8	40	4.8	1.7	2.3	13.2	13.6	2.5
1990	426	151	55	50	10	38	4.8	1.7	2.3	11.7	13.8	2.5
1991	408	144	55	50	12	39	4.8	1.7	2.3	11.6	13.1	2.5
1992	390	138	55	50	14	37	4.8	1.7	2.3	11.9	13.1	1.7
1993	371	131	55	50	16	37	4.8	1.7	2.3	12.7	13.3	1.9
1994	353	125	55	50	18	37	4.8	1.7	2.3	11.9	12.6	2.1
1995	334	119	55	50	20	33	4.8	1.7	2.4	11.5	13.1	1.9
1996	316	114	55	50	22	31	4.9	1.8	2.5	12.1	12.8	1.8
1997	297	108	55	20	24	32	4.9	1.8	2.5	15.0	12.6	1.9
1998	279	102	55	20	26	34	4.9	1.8	2.6	13.2	11.8	1.8
1999	276	101	49	20	28	32	4.8	1.8	2.5	14.8	12.2	1.9
2000	240	88	49	20	30	31	4.7	1.7	2.4	13.9	12.2	2.0
2001	225	82	31	20	30	30	4.5	1.7	2.3	14.3	12.6	2.1
2002	220	80	27	20	30	29	4.4	1.6	2.2	14.2	12.6	2.1
2003	210	77	21	20	30	26	4.4	1.6	2.2	14.4	13.1	2.1
2004	220	82	34	20	30	28	4.4	1.6	2.2	14.0	12.4	1.9
2005	219	82	33	20	30	28	4.3	1.6	2.2	14.4	12.2	2.0
2006	183	70	37	20	30	26	4.3	1.6	2.1	14.4	12.5	2.1
2007	180	70	36	20	30	25	4.3	1.7	2.1	15.0	12.7	2.2
2008	171	67	24	20	30	25	4.2	1.7	2.1	16.0	11.9	2.1
2009	168	67	27	20	30	24	4.2	1.7	2.1	16.1	12.2	2.0
2010	169	69	25	20	30	23	4.1	1.7	2.0	15.7	12.1	1.9
2011	175	73	22	20	30	24	4.1	1.7	2.0	16.1	12.3	2.0
2012	171	64	24	20	30	24	4.0	1.5	1.9	16.1	11.6	2.0
2013	182	68	19	20	30	22	4.0	1.5	1.9	15.6	11.0	1.9
2014	185	69	17	0	30	24	4.0	1.5	1.9	16.7	11.3	2.0
2015	189	71	15	0	30	22	4.0	1.5	1.9	12.5	11.2	2.0
2016	187	70	16	0	30	24	4.0	1.5	1.9	14.4	11.1	2.0
2017	180	68	20	0	30	23	4.0	1.5	1.9	17.0	10.9	2.0
2018	180	68	15	0	30	24	4.0	1.5	1.9	13.8	11.4	1.9

Table S2. Emission factors used for the calculations of inputs and outputs of silage maize cultivation on a dry sandy soil.

Year	NH ₃ emission factor		N ₂ O emission factor		NO emission factor, % of N	NO ₃ leaching fraction, % of N surplus on soil balance
	slurry, % of TAN	fertilizer, % of N	slurry, % of N	fertilizer, % of N		
1985	64.0	2.9	0.6	1.3	1.2	0.83
1986	64.0	2.9	0.6	1.3	1.2	0.83
1987	64.0	2.9	0.6	1.3	1.2	0.83
1988	64.0	2.9	0.6	1.3	1.2	0.83
1989	64.0	2.9	0.6	1.3	1.2	0.83
1990	64.0	2.9	0.6	1.3	1.2	0.83
1991	62.8	3.1	0.6	1.3	1.2	0.83
1992	34.0	2.9	1.3	1.3	1.2	0.83
1993	34.0	2.9	1.3	1.3	1.2	0.83
1994	34.0	2.9	1.3	1.3	1.2	0.83
1995	25.0	2.9	1.3	1.3	1.2	0.83
1996	25.0	3.0	1.3	1.3	1.2	0.83
1997	25.0	3.0	1.3	1.3	1.2	0.83
1998	25.0	2.9	1.3	1.3	1.2	0.83
1999	25.0	3.0	1.3	1.3	1.2	0.83
2000	20.9	3.1	1.3	1.3	1.2	0.83
2001	20.9	3.3	1.3	1.3	1.2	0.83
2002	20.9	3.7	1.3	1.3	1.2	0.83
2003	20.9	4.3	1.3	1.3	1.2	0.83
2004	20.9	4.1	1.3	1.3	1.2	0.83
2005	21.6	4.0	1.3	1.3	1.2	0.83
2006	21.6	4.3	1.3	1.3	1.2	0.83
2007	21.6	3.7	1.3	1.3	1.2	0.83
2008	6.3	3.6	1.3	1.3	1.2	0.83
2009	6.3	3.3	1.3	1.3	1.2	0.83
2010	6.3	3.2	1.3	1.3	1.2	0.83
2011	6.3	3.4	1.3	1.3	1.2	0.83
2012	6.3	3.7	1.3	1.3	1.2	0.83
2013	6.3	3.7	1.3	1.3	1.2	0.83
2014	6.3	3.9	1.3	1.3	1.2	0.83
2015	5.0	3.9	1.3	1.3	1.2	0.83
2016	5.0	3.4	1.3	1.3	1.2	0.83
2017	5.0	3.5	1.3	1.3	1.2	0.83
2018	5.0	3.5	1.3	1.3	1.2	0.83

Table S3. Results of calculations of N and P yields, surpluses, use efficiencies and NH₃, N₂O, and NO emissions for silage maize cultivation on a dry sandy soil for a farm with derogation (from 2006) and use of cattle slurry.

Year	N yield	P yield	N surplus	P surplus	NH ₃	N ₂ O	NO	NO ₃ leaching	Un- accounted for	NUE	PUE
	kg N/ha	kg P ₂ O ₅ / ha	kg N/ha	kg P ₂ O ₅ /ha	kg N/ha	kg N/ha	kg N/ha	kg N/ha	kg N/ha	%	%
1985	153	64	442	163	153	3.7	6.7	264	44	26	28
1986	184	78	413	150	155	3.7	6.7	237	38	31	34
1987	161	68	419	153	149	3.6	6.4	246	40	28	31
1988	173	73	391	141	144	3.5	6.2	225	36	31	34
1989	180	76	368	132	138	3.4	6.0	209	33	33	37
1990	161	67	368	134	132	3.3	5.8	212	34	31	33
1991	152	66	362	128	125	3.3	5.6	212	35	29	34
1992	156	46	340	142	65	5.8	5.3	241	38	31	25
1993	169	55	310	126	62	5.5	5.1	217	34	35	31
1994	150	57	312	118	59	5.3	4.9	220	35	32	33
1995	151	50	291	119	43	5.1	4.7	215	34	34	30
1996	155	50	269	114	41	4.8	4.5	195	31	37	30
1997	189	65	220	63	40	4.6	4.2	154	23	46	51
1998	156	54	238	68	39	4.3	4.0	169	26	40	44
1999	180	64	205	57	38	4.2	3.9	141	21	47	53
2000	170	64	180	44	27	3.8	3.5	127	19	49	59
2001	180	69	136	33	25	3.3	3.1	92	12	57	67
2002	179	68	127	32	24	3.2	3.0	85	11	59	68
2003	189	69	98	28	23	3.0	2.8	63	7	66	71
2004	174	61	138	41	24	3.3	3.0	94	13	56	60
2005	176	66	134	36	25	3.3	3.0	90	12	57	65
2006	180	69	96	21	21	2.9	2.6	62	7	65	77
2007	190	75	81	14	21	2.8	2.6	50	5	70	84
2008	191	77	59	10	6	2.5	2.3	44	4	76	88
2009	196	74	53	14	6	2.5	2.3	39	3	79	84
2010	190	68	58	21	6	2.5	2.3	43	4	77	77
2011	198	74	53	19	6	2.6	2.4	39	3	79	80
2012	187	74	62	10	6	2.5	2.3	47	5	75	88
2013	172	68	81	20	6	2.6	2.4	62	8	68	77
2014	189	77	67	-7	6	2.6	2.4	51	5	74	110
2015	140	57	117	14	5	2.7	2.5	93	14	54	81
2016	160	66	97	4	5	2.6	2.4	77	11	62	94
2017	185	78	68	-10	5	2.6	2.4	52	6	73	115
2018	157	60	92	8	5	2.5	2.3	73	10	63	89