

**Table S1.** Characteristics of the grassland survey sites.

Farm	Coordinates	Layer	Soil texture			Soil reaction	OM	K	P	N
			<i>Sand</i>	<i>Silt</i>	<i>Clay</i>					
		(cm)	%	%	%	pH	%	mg kg <sup>-1</sup>	mg kg <sup>-1</sup>	g kg <sup>-1</sup>
1	44.661, 10.444	0-15	12	49	39	7.37	3.0	384	226	2.0
		15-30	9	54	37	7.27	2.6	357	194	2.1
		30-60	11	50	39	7.64	1.0	161	27	0.9
	44.659, 10.442	0-15	10	52	38	7.56	5.8	724	154	3.1
		15-30	9	52	39	7.76	1.8	671	45	1.0
		30-60	11	52	37	7.83	1.0	582	32	0.6
	44.658, 10.443	0-15	11	52	37	7.34	2.9	380	236	2.2
		15-30	10	50	40	7.30	2.2	340	170	2.1
		30-60	11	49	40	7.58	1.0	199	30	0.9
2	44.710, 10.492	0-15	6	57	37	7.34	5.0	689	285	3.1
		15-30	9	55	37	7.77	4.7	226	156	2.8
		30-60	11	52	37	8.00	1.4	223	54	0.9
	44.708, 10.490	0-15	9	57	34	7.77	4.7	900	276	2.9
		15-30	24	39	37	7.88	3.4	641	200	1.8
		30-60	11	52	37	7.78	3.8	818	271	2.4
	44.707, 10.490	0-15	7	55	38	7.70	4.8	890	270	2.0
		15-30	8	52	40	7.80	3.7	640	211	1.8
		30-60	12	52	36	7.70	1.9	790	272	1.1
3	44.653, 10.450	0-15	17	65	18	7.08	6.7	650	442	4.2
		15-30	12	57	31	7.31	2.1	449	83	1.6
		30-60	17	52	31	7.53	1.1	246	31	0.9
	44.653, 10.449	0-15	8	56	36	7.02	6.4	648	440	4.1
		15-30	8	51	41	7.32	2.1	440	90	1.5
		30-60	12	50	38	7.48	1.2	216	32	0.8
	44.654, 10.449	0-15	7	55	38	7.12	6.1	658	450	3.9
		15-30	8	53	39	7.34	2.1	460	90	1.5
		30-60	13	53	34	7.54	1.1	230	29	0.9
4	44.755, 10.490	0-15	11	52	37	7.64	8.0	385	382	4.8
		15-30	16	42	42	7.91	1.6	228	57	0.9
		30-60	11	47	42	7.82	0.7	201	28	0.4
	44.755, 10.491	0-15	11	52	37	7.64	6.7	370	380	4.7
		15-30	10	50	40	7.90	1.8	230	43	1.1
		30-60	11	49	40	7.79	0.9	190	29	0.6
	44.758, 10.489	0-15	7	56	37	7.70	6.4	370	380	4.6
		15-30	8	53	39	7.90	1.5	230	58	0.9
		30-60	14	53	33	7.78	0.7	216	30	0.3
5	44.665, 10.517	0-15	11	52	37	6.73	2.4	206	148	1.4
		15-30	4	62	34	7.03	1.9	208	166	1.5
		30-60	9	57	34	7.33	1.1	144	93	0.9
	44.666, 10.517	0-15	22	65	13	7.32	9.4	326	429	5.6
		15-30	9	57	34	7.26	5.9	251	209	3.9
		30-60	11	52	37	7.46	2.9	155	172	2.1
	44.666, 10.518	0-15	20	66	14	7.30	9.1	329	414	4.9
		15-30	10	55	35	7.28	5.8	263	249	3.8
		30-60	10	54	36	7.42	2.8	201	160	1.9

OM = organic matter, K = exchangeable K, P = assimilable P, N = total N.

**Table S2.** Chemical characteristics of the raw livestock manures.

Parameters	Farmyard manure				
	1	2	3	4	5
TS (% WB)	17.89	15.55	16.84	17.15	18.30
Total N (% WB)	2.27	2.77	2.51	2.30	2.40
N-NH <sub>4</sub> <sup>+</sup> (% WB)	32.41	23.49	21.93	23.00	29.06

TS = total solids, WB = wet basis, N = nitrogen, N-NH<sub>4</sub><sup>+</sup> = ammoniacal N.

**Table S3.** Statistical analysis of Near-Infrared Reflectance Spectroscopy data with details on the interaction Farm x Year.

Item	Harvest	Farms					Year		Farm	Year x Farm
		1	2	3	4	5				
							mean	p	p	p
Yield (Mg of DM ha <sup>-1</sup> )	2017	5.9 <sup>g</sup>	3.7 <sup>h</sup>	7.2 <sup>e</sup>	8.1 <sup>d</sup>	10.9 <sup>b</sup>	7.2 <sup>b</sup>	0.001	0.001	0.001
	2018	6.4 <sup>f</sup>	6.7 <sup>f</sup>	10.0 <sup>c</sup>	10.3 <sup>c</sup>	12.6 <sup>a</sup>	9.2 <sup>a</sup>			
Plants per transept (number)	2017	102 <sup>bc</sup>	79 <sup>cde</sup>	73 <sup>de</sup>	112 <sup>ab</sup>	71 <sup>de</sup>	88	n.s.	0.001	0.020
	2018	131	93 <sup>bcd</sup>	59 <sup>e</sup>	93 <sup>bcd</sup>	62 <sup>e</sup>	88			
SolP (% of DM)	2017	3.8 <sup>b</sup>	3.9 <sup>b</sup>	4.3 <sup>ab</sup>	2.3 <sup>c</sup>	4.6 <sup>ab</sup>	3.8 <sup>b</sup>	0.003	n.s.	0.041
	2018	4.8 <sup>ab</sup>	5.5 <sup>a</sup>	4.1 <sup>ab</sup>	4.6 <sup>ab</sup>	4.5 <sup>ab</sup>	4.7 <sup>a</sup>			

SolP = soluble protein. Different letters within each column indicate significant differences (within a variable) between treatments and/or year according to Duncan's range test ( $p < 0.05$ ). n.s. = not significant.

**Table S4.** Botanical composition of individual plant species in monitored permanent grassland.

Poaceae	Fabaceae	Other species
<i>Agropyron</i> spp. <i>Alopecurus pratensis</i> L. <i>Alopecurus utriculatus</i> (L.) Pers. <i>Bromus hordeaceus</i> L. <i>Dactylis glomerata</i> L. <i>Festuca arundinacea</i> Schreb. <i>Festuca pratensis</i> Huds. <i>Lolium multiflorum</i> Lam. <i>Lolium perenne</i> L. <i>Poa sylvicola</i> Guss. <i>Hordeum murimum</i> L.	<i>Trifolium pratense</i> L. <i>Trifolium repens</i> L. <i>Vicia sativa</i> L.	<i>Achillea millefolium</i> L. <i>Calepina irregularis</i> (Asso) Thell. <i>Capsella bursa-pastoris</i> (L.) Medik. <i>Cerastium</i> spp. <i>Cirsium arvense</i> (L.) Scop. <i>Convolvulus arvensis</i> L. <i>Crepis biennis</i> L. <i>Dianthus caryophyllus</i> L. <i>Galium</i> spp. <i>Geranium dissectum</i> L. <i>Lamium</i> spp. <i>Lychnis flos-cuculi</i> L. <i>Malva sylvestris</i> L. <i>Ornithogalum umbellatum</i> L. <i>Plantago lanceolata</i> L. <i>Plantago major</i> L. <i>Potentilla</i> spp. <i>Ranunculus</i> spp. <i>Rumex acetosa</i> L. <i>Silene vulgaris</i> (Moench) Garcke <i>Sinapis arvensis</i> L. <i>Stellaria media</i> (L.) Vill. <i>Taraxacum officinale</i> (L.) Weber <i>Tragopogon pratensis</i> L. <i>Veronica persica</i> Poir.