

Supplementary Materials

Table S1 Maize fertilizer application at E1 (Vredepeel, the Netherlands) during the analysed period (2013 -2019)

	2013	2014	2015	2016	2017	2018	2019
Organic fertilizer (kg N ha⁻¹)	202	164	161	161	96	125	146
Mineral fertilizer (kg N ha⁻¹)	55	27	27	27	27	21	27

Table S2 Crops and fertilizer application rates at E3 'Schuby, Denmark' analysed period (2012 -2020), SM =forage maize, WR = winter rye and RG = ryegrass

	2012	2013	2013	2014	2015 ²	2016	2017	2018	2019
Crop type	SM	WR	RG	SM	SM	WR	SM	SM	SM
Cultivar and maturity class¹	Fernandez S250			P7524 S200			Kartagas S230	Kartags S230	Amaveritas S240
Organic fertilizer (kg N ha⁻¹)	117	82	47 47 53	82	77	79	137	88	182
Mineral fertilizer (kg N ha⁻¹)	27 46	32 46	81	27 38	29 54	69 27 34	21 35	18 28	14 32

¹ Early maturity cultivar (S170-220), mid-early cultivar (S230-250), mid-late cultivar (S60-290), late cultivar (300-350)

² Cultivar sown was not available

Table S3. Soil physical characteristics used for E1 (Vredepeel, the Netherlands). BD = bulk density, AirDry = water content of air dry soil, LL15 = lower limit or permanent wilting point at -15 bar, DUL = drained upper limit or field capacity, SAT = saturated limit. The soil C:N ratio was set to 15

Depth Cm	BD (g/cc)	AirDry (mm/mm)	LL15 (mm/mm)	DUL (mm/mm)	SAT (mm/mm)
0-10	1.44	0.024	0.047	0.251	0.401
10-25	1.50	0.038	0.047	0.251	0.384
25-50	1.50	0.047	0.047	0.251	0.384
50-100	1.50	0.047	0.047	0.251	0.384
100-150	1.50	0.047	0.047	0.251	0.384

Table S4. Soil physical characteristics used for modelling E2 (Jyndevad, Denmark) and E3 (Schuby, Germany). BD = bulk density, AirDry = water content of air dry soil, LL15 = lower limit or permanent wilting point at -15 bar, DUL = drained upper limit or field capacity, SAT = saturated limit. The soil C:N ratio was set to 11 for E2 and to 15 for E3

Depth	BD	AirDry	LL15	DUL	SAT
(cm)	(g/cc)	(mm/mm)	(mm/mm)	(mm/mm)	(mm/mm)
0-28	1.35	0.023	0.046	0.149	0.429
28-35	1.41	0.037	0.046	0.149	0.429
35-43	1.41	0.046	0.046	0.149	0.429
43-52	1.55	0.046	0.046	0.149	0.429
52-68	1.76	0.046	0.046	0.149	0.429
68-75	1.80	0.046	0.046	0.149	0.429
75-80	1.80	0.046	0.046	0.149	0.429
80-100	1.79	0.046	0.046	0.149	0.429
100-150	1.79	0.046	0.046	0.149	0.429

Table S5. Soil NH₄ and NO₃ values used to initialize APSIM for E1 (Vredepeel, the Netherlands)

	2013		2014		2015		2016		2017		2018		2019	
Depth	NO3	NH4	NO3	NH4	NO3	NH4	NO3	NH4	NO3	NH4	NO3	NH4	NO3	NH4
(cm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
0-10	3.188	0.354	7.500	0.883	3.438	0.382	2.500	0.278	3.938	0.438	0.531	0.059	1.875	0.208
10-25	2.040	0.227	4.800	0.533	2.200	0.244	1.600	0.178	2.520	0.280	0.340	0.038	1.200	0.133
25-50	1.224	0.136	2.880	0.320	1.320	0.147	0.960	0.107	1.512	0.168	0.204	0.023	0.720	0.080
50-100	0.061	0.007	0.144	0.016	0.066	0.007	0.048	0.005	0.076	0.008	0.010	0.001	0.036	0.004
100-150	0.061	0.007	0.144	0.016	0.066	0.007	0.048	0.005	0.076	0.008	0.010	0.001	0.036	0.004

Table S6 Observed and estimated emergence and flowering dates (nth day of the year) in E1 (Vredepeel, the Netherlands).

Year	Emergence	Emergence APSIM	Flowering	Flowering date APSIM
2013	147	143	219	223
2014	119	120	212	209
2015	128	128	196	216
2016	132	132	217	214
2017	138	137		
2018	131	133	201	206
2019	136	134		

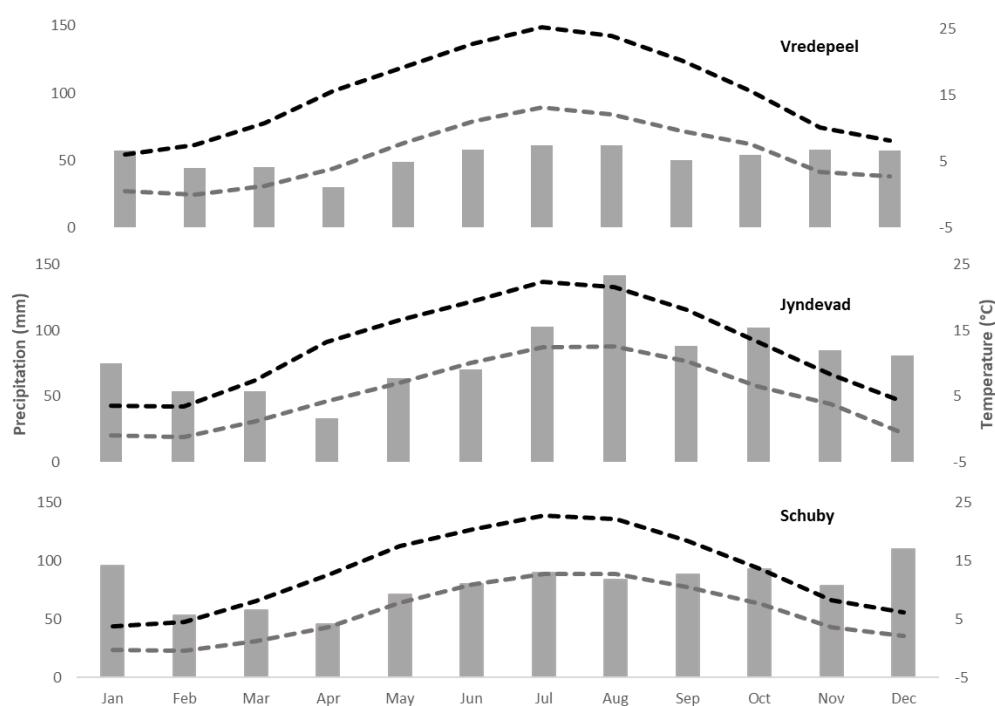


Figure S1. Average climate conditions of E1 (Vredepeel, the Netherlands) for the period 2013-2019, E2 (Jynde vad, Denmark) for the period 2006 -2012 and E3 (Schuby, Germany) for the period 2012 -2019 used for modelling in APSIM. Precipitation is average monthly sum (bars), maximum (dashed black line) and minimum (dashed grey line) temperature is monthly average of the daily value.