

Aberystwyth University

UV responses of Lolium perenne raised along a latitudinal gradient across Europe

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Appendix S2: Mean climatic data from each of the locations used throughout this analysis.

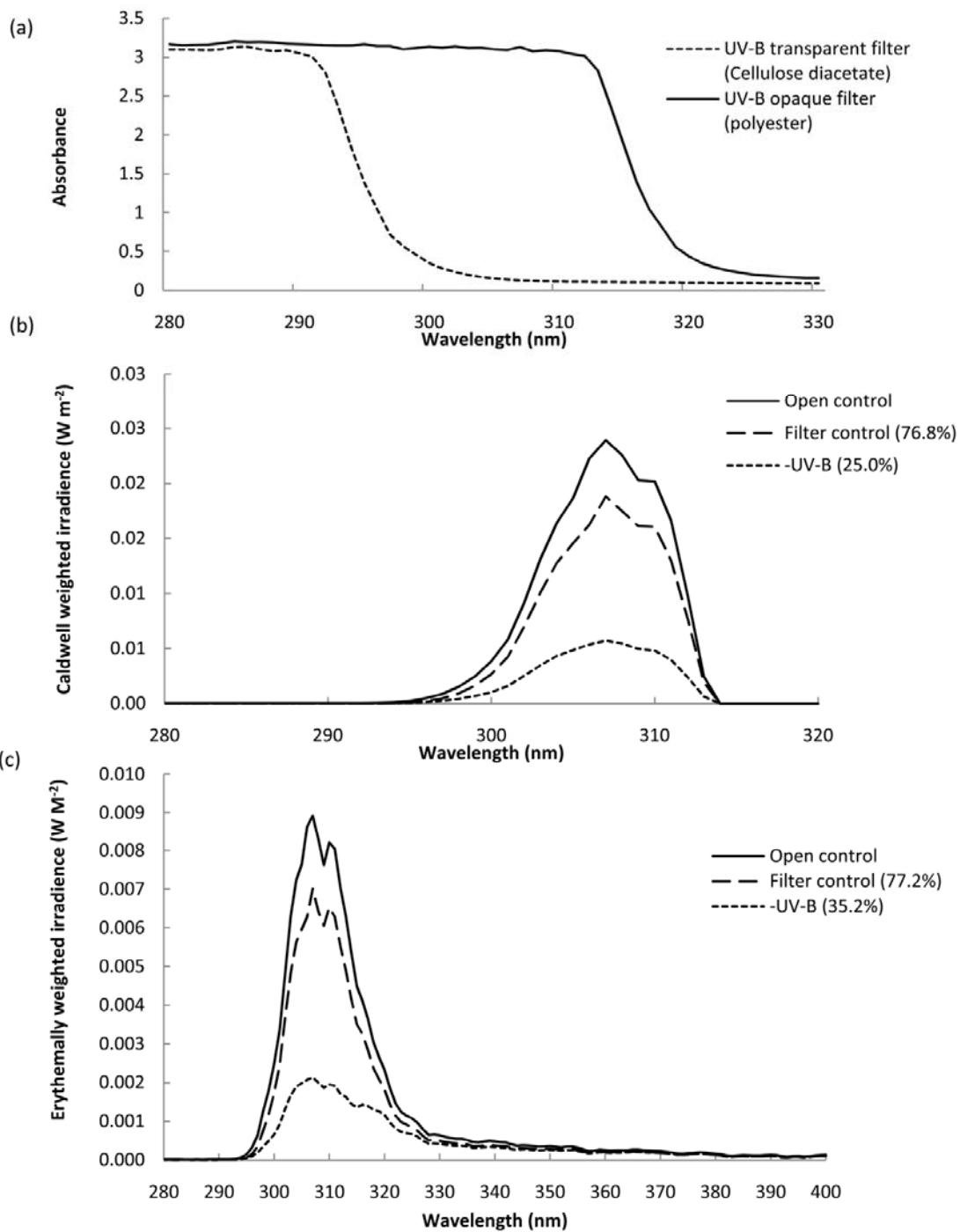
Location	Lat	Long	Max temp (°C)	Mean temp (°C)	Min temp (°C)	Max humidity (%)	Mean humidity (%)	Min humidity (%)	Max pressure (hPa)	Mean pressure (hPa)	Min pressure (hPa)	Max windsp (Km/h)	Mean windsp (Km/h)	UV dose (kJ/m ²)	Cloud fraction	Mean day length
Malaga, Spain	36.72	-4.47	28.33	24.76	21.49	83.63	64.88	44.72	1016.32	1014.60	1012.89	24.51	7.38	4.68	878.18	14.37
Logrono, Spain	42.47	-2.42	26.79	20.76	14.67	92.35	69.06	46.33	1020.61	1018.76	1016.90	26.15	11.33	4.55	930.70	14.91
Belgrade, Serbia	44.82	20.46	28.26	22.86	17.28	94.68	69.88	43.14	1016.14	1014.47	1012.81	20.06	9.43	3.86	858.15	15.16
Ljubljana, Slovenia	46.27	10.48	29.78	21.29	15.25	93.60	74.47	47.67	1016.64	1014.65	1012.65	15.54	0.29	4.46	914.82	15.33
Innsbruck, Austria	47.27	11.40	24.49	18.94	13.15	94.82	71.60	48.22	1020.53	1018.39	1016.25	20.10	6.42	4.31	906.73	15.46
Vienna, Austria	48.12	16.37	26.26	20.93	15.93	87.35	69.21	50.19	1017.94	1016.12	1014.29	15.46	7.64	3.64	840.42	15.57
Munich, Germany	48.22	11.60	25.97	20.68	15.69	84.17	68.92	51.58	1018.96	1016.96	1014.96	16.26	2.86	3.85	869.27	15.58
Cork, Ireland	51.90	-8.47	18.58	15.18	12.10	98.75	88.36	70.86	1016.86	1013.96	1011.06	23.71	10.19	2.68	681.24	16.12
Grossbeeren, Germany	52.35	13.31	30.40	22.96	16.43	88.04	64.54	41.72	1012.53	1010.46	1008.39	15.40	1.75	3.32	809.36	16.20
Orebro, Sweden	59.28	15.22	25.57	18.53	12.65	93.31	75.06	49.53	1014.17	1009.62	1005.07	12.64	0.57	2.90	785.16	17.62
As, Norway	59.66	10.78	22.78	17.72	13.63	93.22	75.19	53.57	1013.71	1004.24	994.78	20.13	3.57	2.67	758.18	17.78
Helsinki, Finland	60.23	25.02	25.57	20.47	15.03	93.74	67.68	44.36	1016.29	1014.37	1012.44	22.19	9.72	3.06	813.82	17.95
Rovaniemi, Finland	66.40	26.47	19.63	15.81	11.67	95.47	76.56	57.00	1014.63	1012.05	1009.47	25.25	13.47	2.59	787.85	21.29
Abisko, Sweden	68.33	18.85	15.63	12.47	9.01	92.21	77.19	62.22	1013.32	1011.24	1009.17	23.31	10.89	2.08	676.85	22.72

Appendix S3: ID codes of each of the meteorological stations used to monitor climatic variables over the course of the experiment at www.wunderground.com.

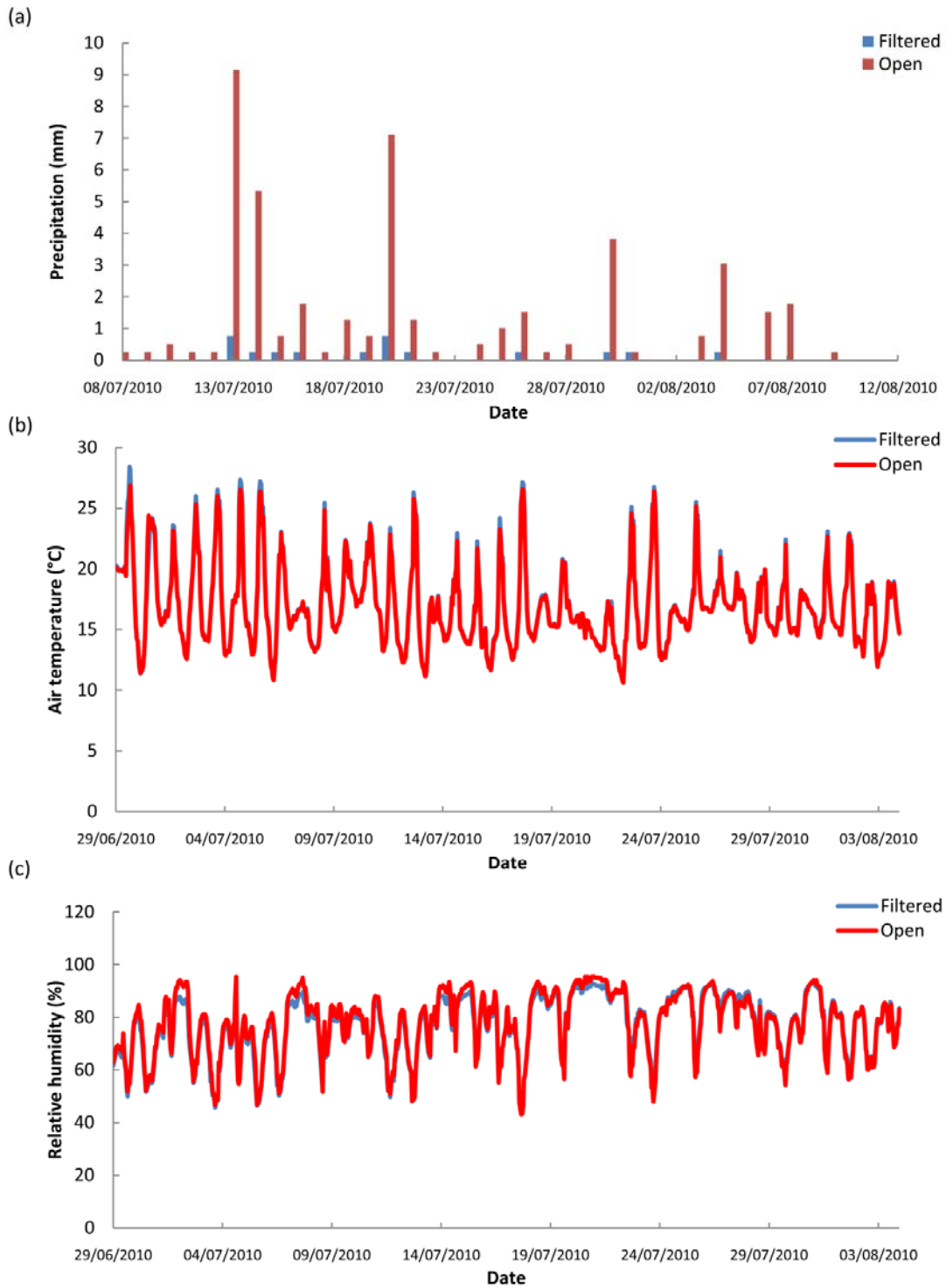
Location	Meteorological station one	Meteorological station two
Malaga, Spain	IANDALUC4	LEMG
Logrono, Spain	LEVT	(LEPP)
Belgrade, Serbia	LYBE	LDOS
Ljubljana, Slovenia	ICERKLJE1	ICENTRAL12
Innsbruck, Austria	LOWI	ETHA
Vienna, Austria	MD4151	LOWW
Munich, Germany	IBAYERNM7	IBAYERNP4
Cork, Ireland	EICK	MAS400
Grossbeeren, Germany	IBERLINB15	IBRANDEN13
Orebro, Sweden	IVRMLAND2	INARKEVI2
As, Norway	IBUSKERU13	MD3152
Helsinki, Finland	EFHK	EFHF
Rovaniemi, Finland	EFRO	EFKE
Abisko, Sweden	ENNK	ESNQ



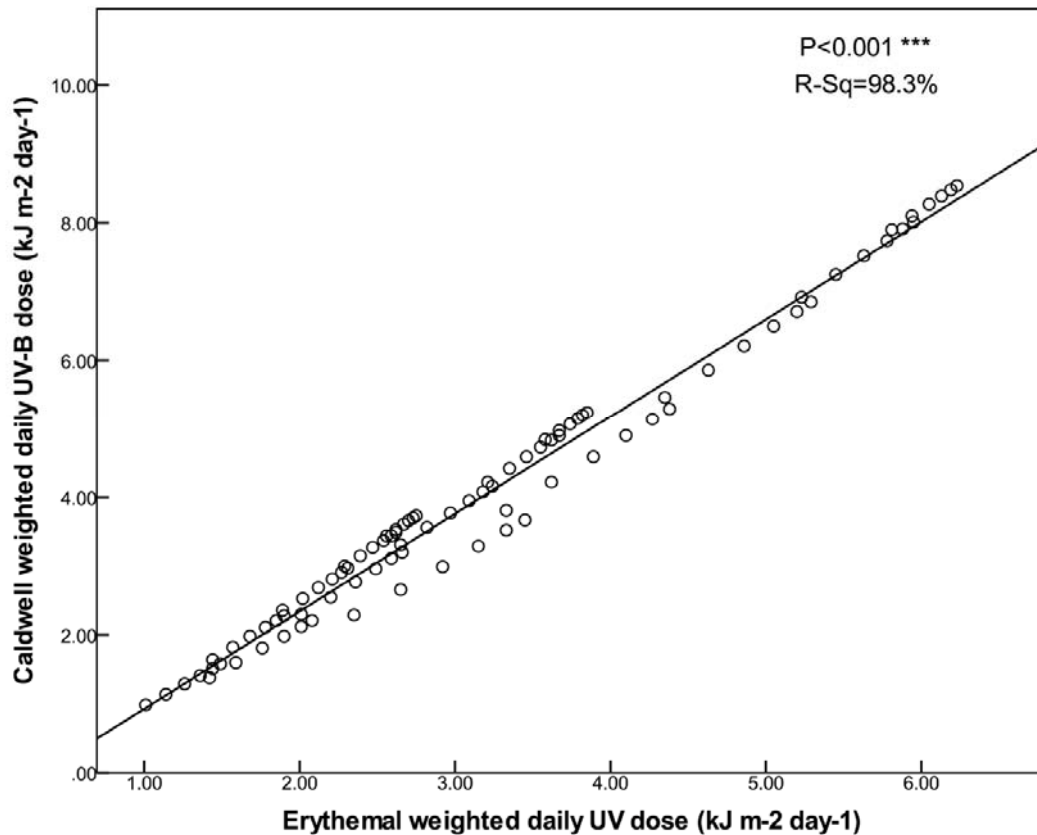
Appendix S4: An example of the filtration frames used throughout the study



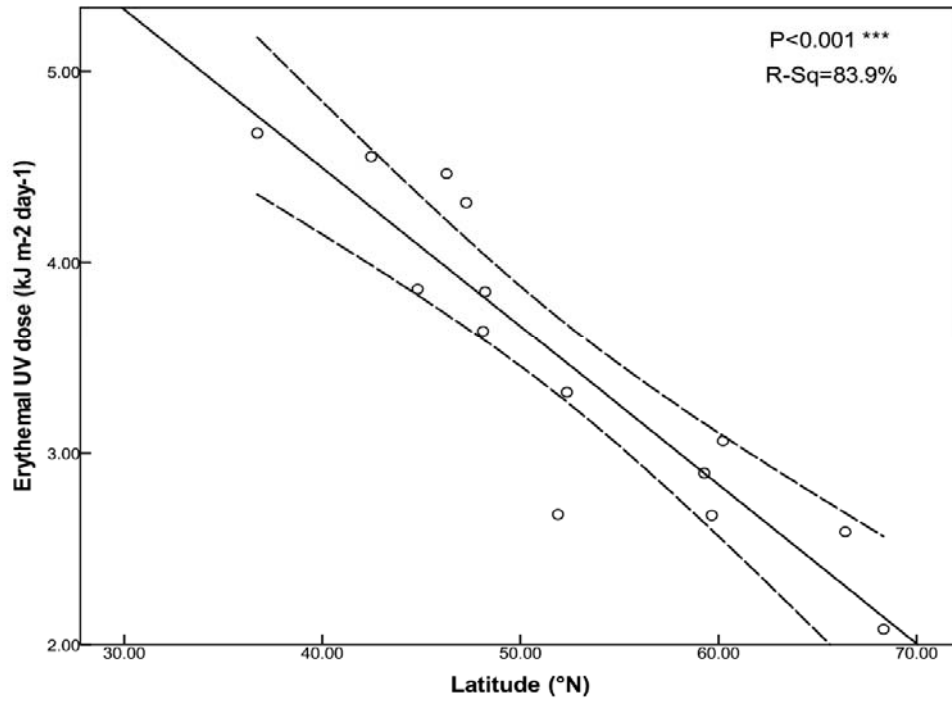
Appendix S5: (a) Spectral quality of the Mylar and cellulose acetate plastics assessed in a spectrophotometer (biomate 5, thermo electron corporation, USA). (b) and (c) show transmission of Caldwell (280-320nm), and CIE (280-400nm) weighted irradiance in the field, taken with a spectroradiometer at 10:00am on June 30th at Logrono (Spain, 42.88°N, 2.73°W). Percentages represent the total weighted UV under each filter type in comparison to ambient levels.



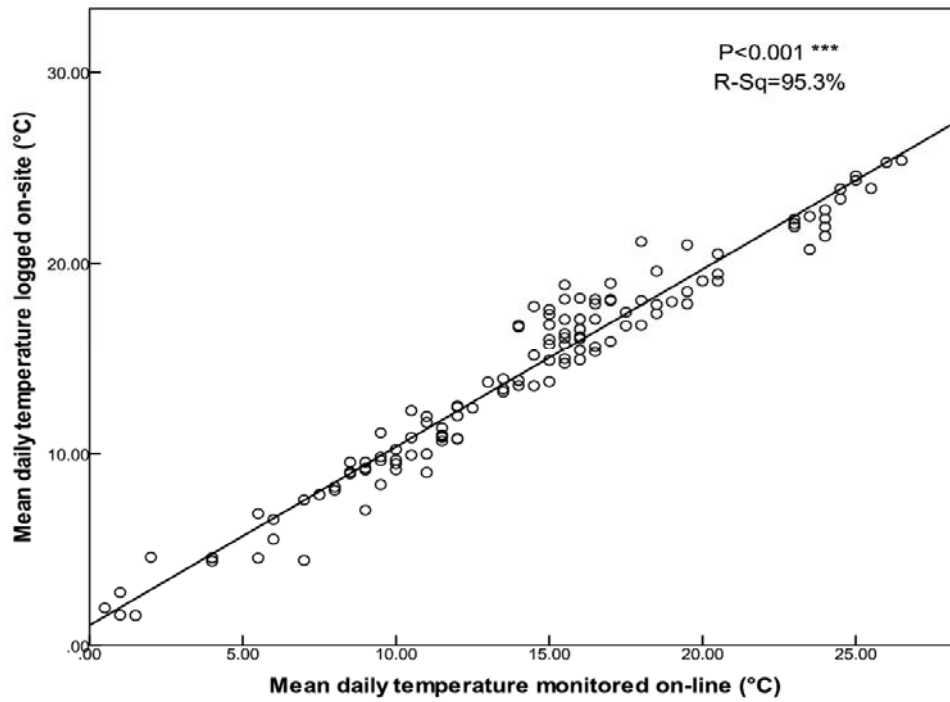
Appendix S6: Change in microclimatic conditions caused by filtration. (a) Precipitation, (b) Air temperature, and (c) Air relative humidity monitored hourly at Aberystwyth, UK, between the 29/6/2010 – 3/8/2010 using two Helios 2 dataloggers per treatment (Skye instruments, Llandrindod Wells, Wales).



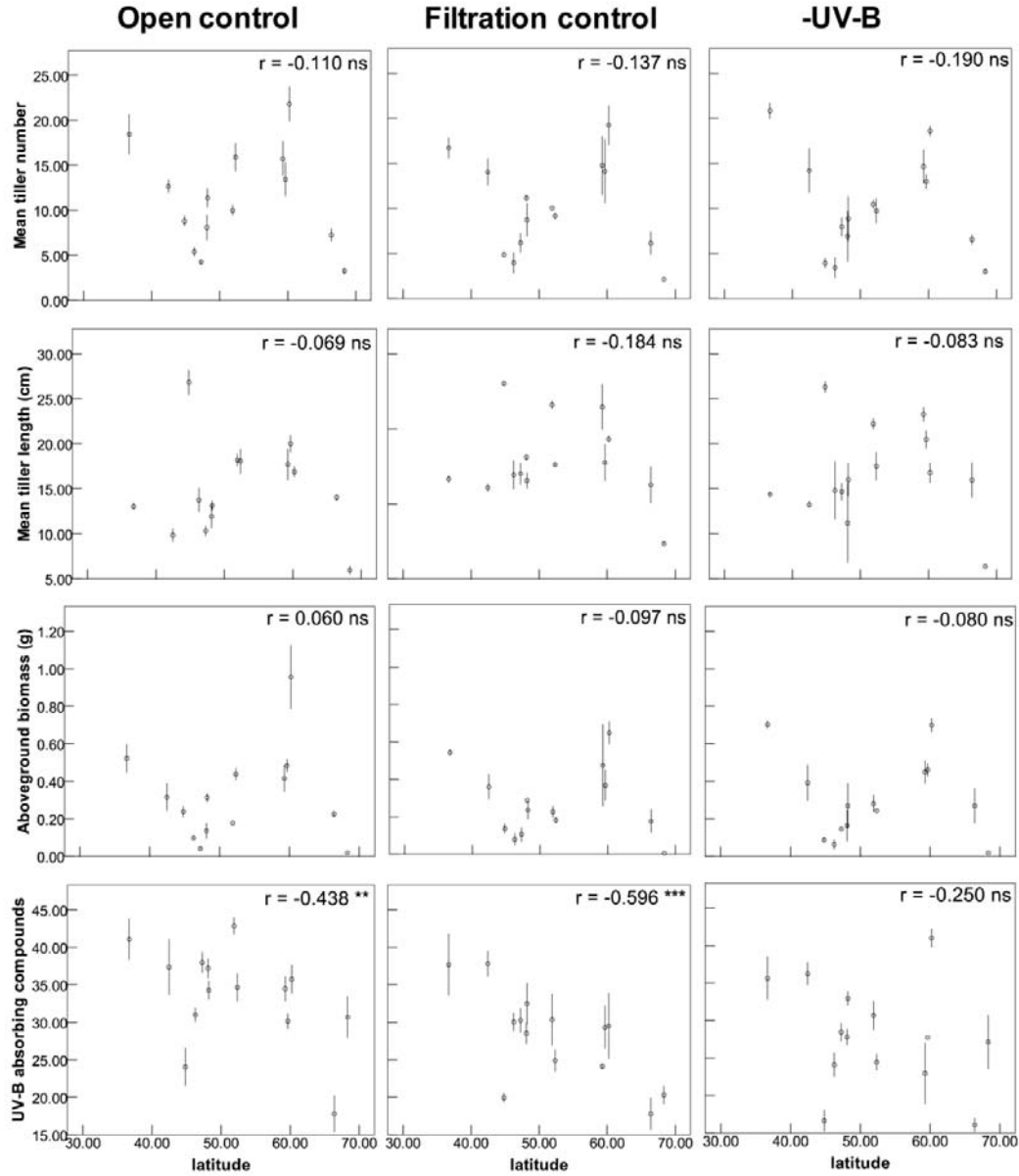
Appendix S7: The ACD: tropospheric ultra-violet (TUV) model (<http://cprm.acd.ucar.edu/Models/TUV/>) has been employed to provide an estimate of the correlation between the daily erythemally weighted UV dose ($\text{kJ m}^{-2} \text{day}^{-1}$) and Caldwell weighted UV-B_{BE} daily dose, using the Caldwell generalised plant damage action spectrum (Caldwell *et al.* 1986). The model was run using latitudes of 30, 40, 50, 60, and 70°N which encompasses the latitudinal gradient observed in this study. UV doses were calculated for six equidistant time points between the 29/6/2010 – 3/8/2010 to span the time period of the experiment. For each latitude and time point the cloud optical depth parameter was varied between 0, 10 and 20 (selected after observing mean cloud optical values from the Modis atmosphere project, http://modis-atmos.gsfc.nasa.gov/MOD08_M3/browse_c51.html) to factor in changes in cloud cover. Hourly spectral irradiances were extracted and weighted using both the erythemal weighting function (CIE), and the Caldwell generalised plant damage action spectrum (Caldwell *et al.* 1986). A linear regression relationship was fitted using minitab statistical software (Minitab version 14, Minitab inc., Coventry, UK). The regression equation for the fitted relationship was: Caldwell weighted daily UV-B_{BE} dose = $-0.4909 + 1.417$ Erythemal weighted daily UV dose.



Appendix S8: Results of a linear regression analysis between Latitude (°N) and the mean erythemal UV dose over the course of the experiment. The 95% confidence band for the fitted regression is shown.



Appendix S9: Comparison of mean daily temperature for Aberystwyth (UK, 52.42°N, -4.07°W) and Munich (Germany, 48.35°N, 11.39°W) monitored on-line using the weather underground website (www.wunderground.com), and on-site using temperature dataloggers.



Appendix S10: Relationship between *L. perenne* growth and UV-B absorbing compound concentrations with latitude in each experimental treatment. Values are the mean (\pm SE) for each location across the latitudinal gradient covered. Results of a Pearson's correlation (r) for each factor against latitude are also shown (* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$).