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Responses of field-grown maize to different soil types, water regimes, and contrasting vapor pressure deficit

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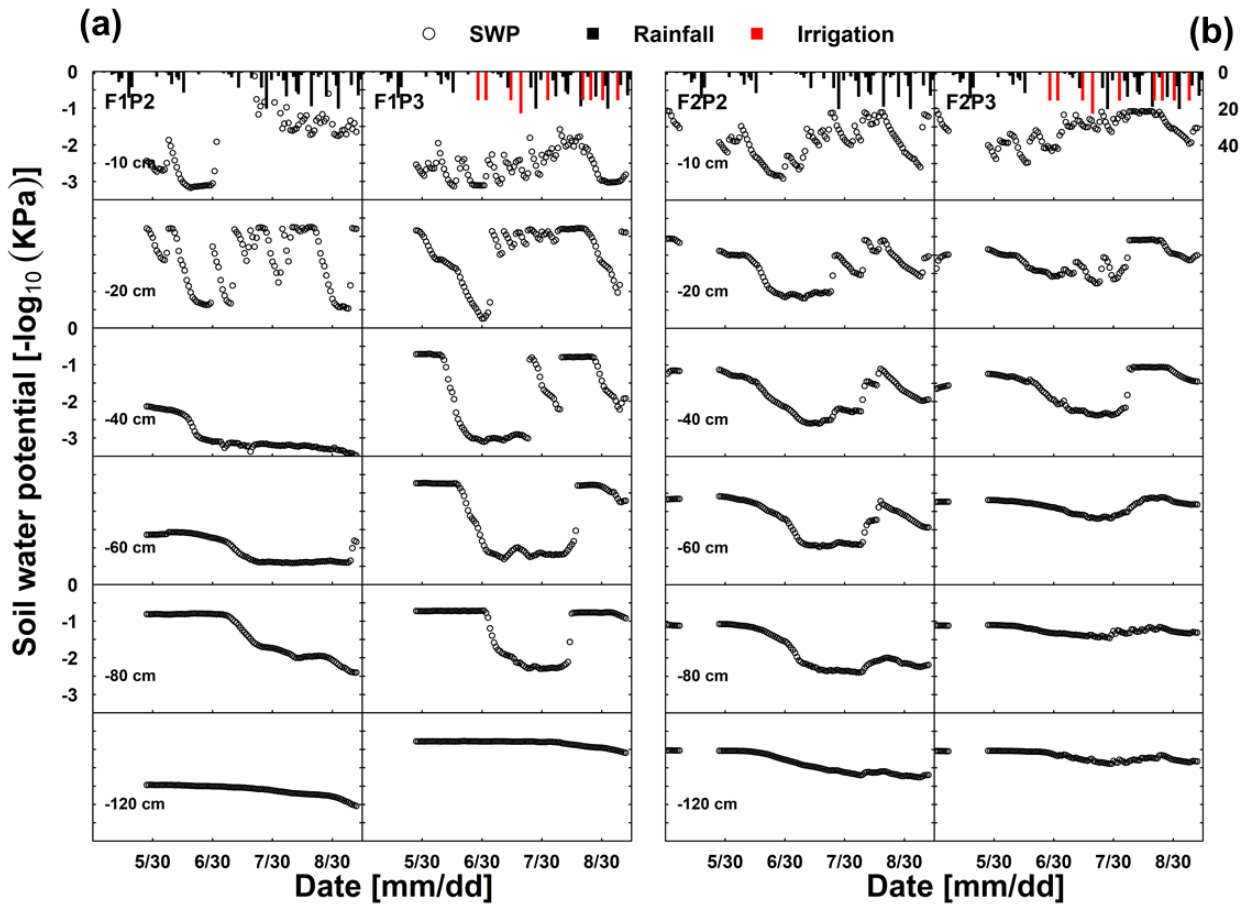

Figure S1: Dynamics of soil water potential measured at different soil depths from the (a) stony soil (F1) and (b) silty soil (F2) with the rainfed (P2) and irrigated (P3) plots in the growing season 2017. Black and red vertical bars indicate the rainfall and irrigation, respectively.

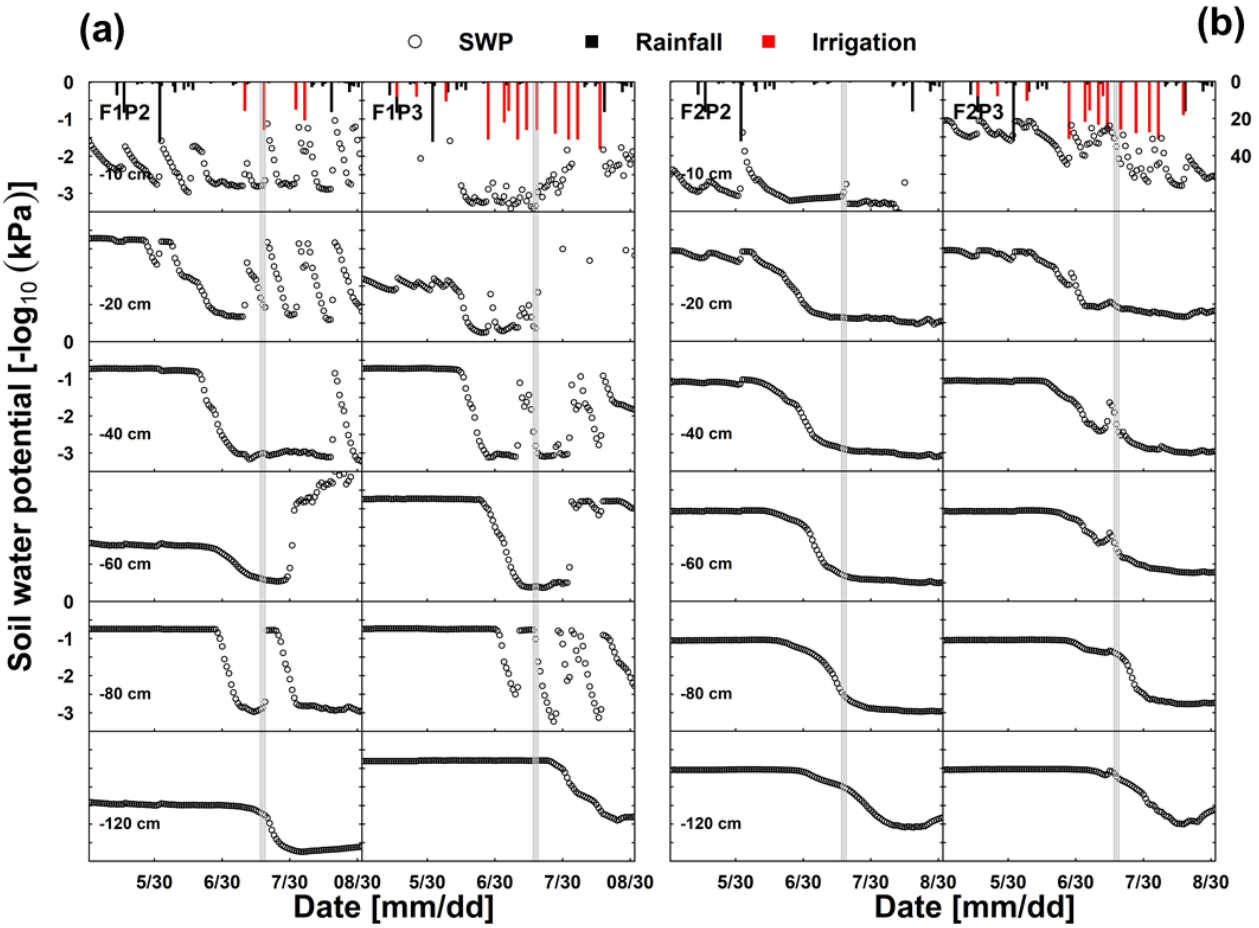

Figure S2: Dynamics of soil water potential measured at different soil depths from the (a) stony soil (F1) and (b) silty soil (F2) with the rainfed (P2) and irrigated (P3) plots in the growing season 2018. Black and red vertical bars indicate the rainfall and irrigation, respectively. Grey bars indicates the three measured days that were shown in Figure 4, 5, and 6.

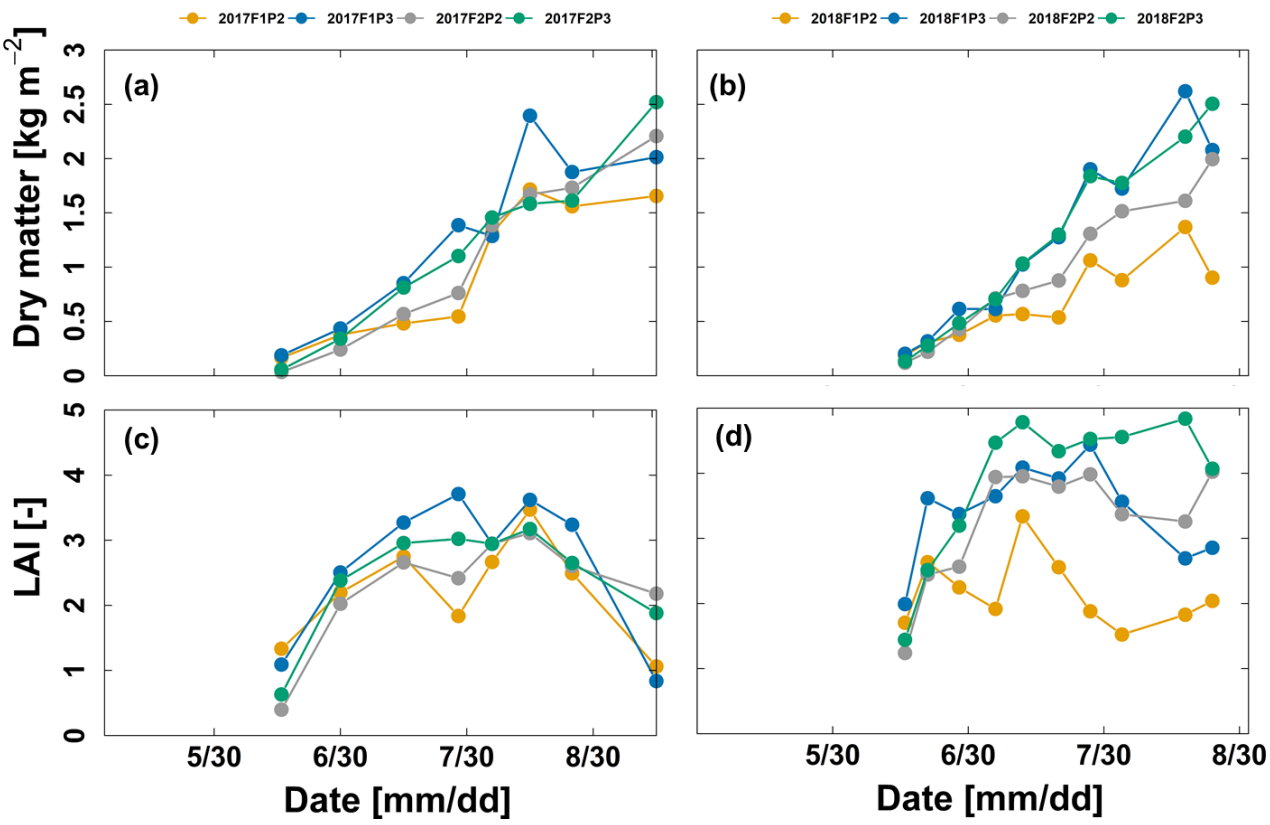

Figure S3: Dynamics of (a, b) aboveground dry matter and (c, d) leaf area index (LAI) in the two growing seasons 2017 (a, c) 2017 and 2018 (b, d) of from the rainfed (P2) and irrigated (P3) plots of the stony soil (F1) and silty soil (F2). Each point represents the average of two sampling replicates, except the harvest with 5 sampling replicates.

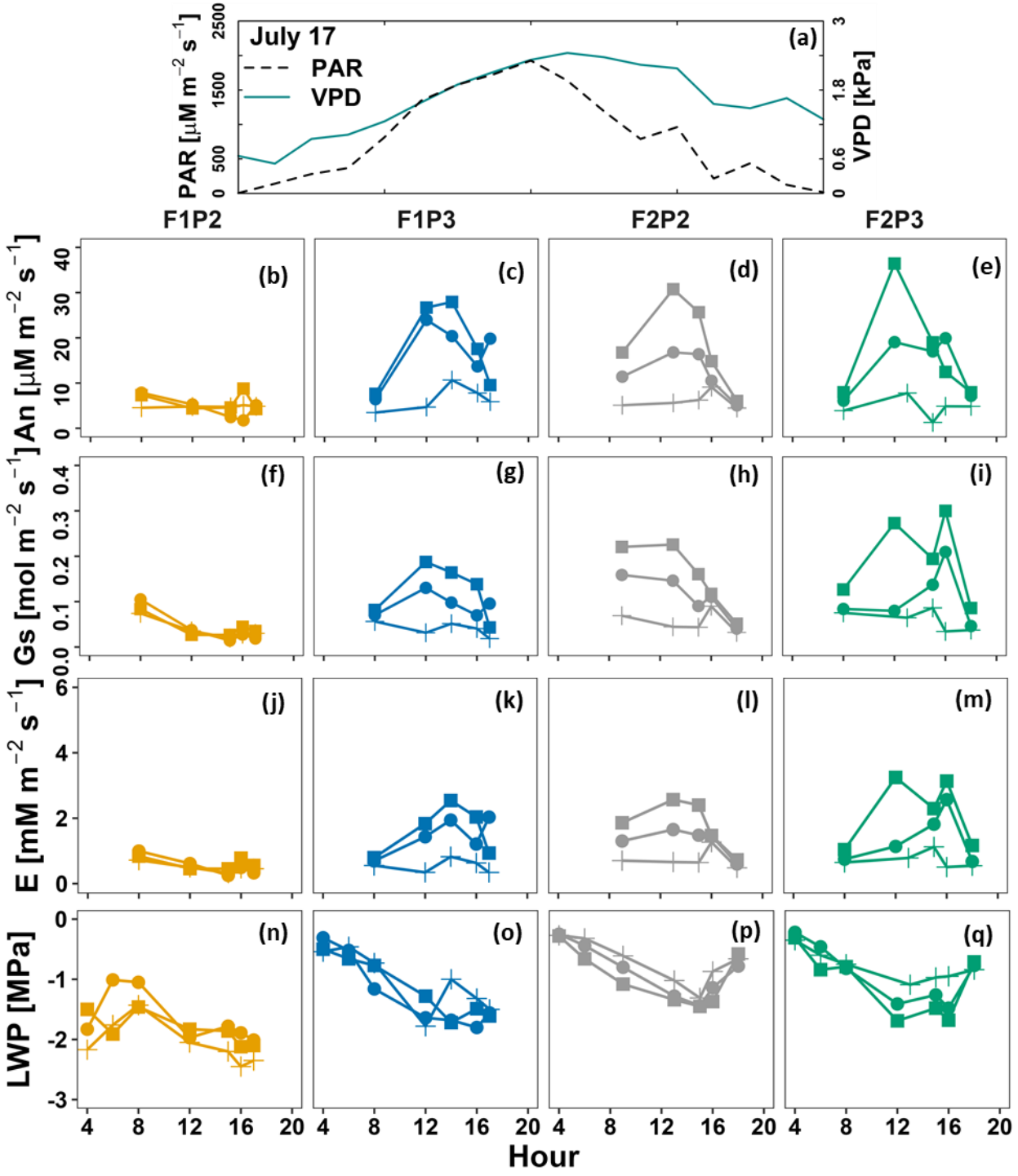

Figure S4. Diurnal course of (a) photosynthetically active radiation (PAR) and vapor pressure deficit (VPD), (b –e) leaf net photosynthesis (An), (f –i) leaf stomatal conductance (Gs), (j –m) leaf transpiration (E), and (n –q) leaf water potential (LWP) on 17 July in maize in 2018 before irrigation at the rainfed (P2) and irrigated (P3) plots of the stony soil (F1) and silty soil (F2). Measurement was carried out from shaded leaf (plus symbol with lines) and two sunlit leaves (solid dot - lines and solid square - lines).

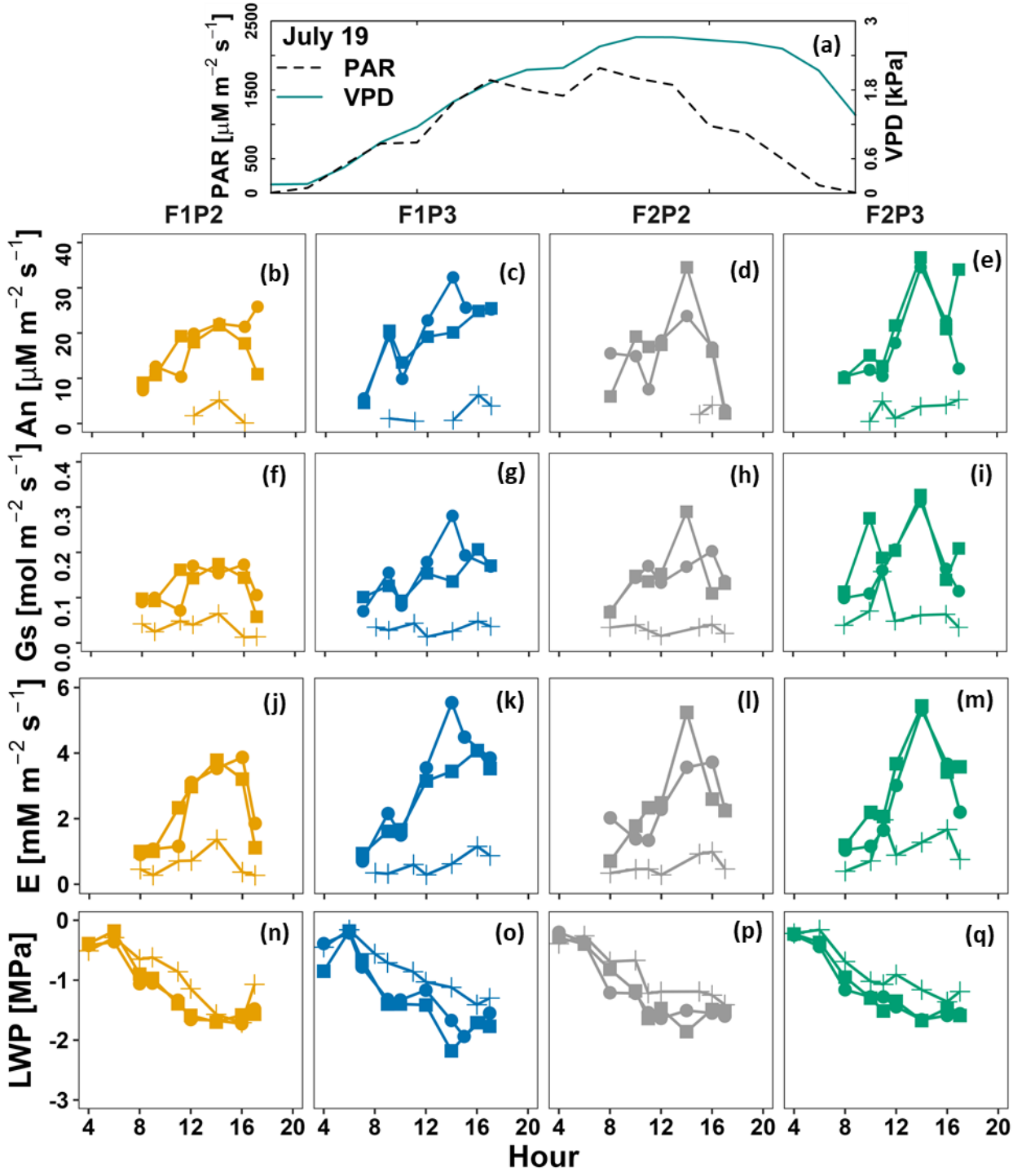

Figure S5. Diurnal course of (a) photosynthetically active radiation (PAR) and vapor pressure deficit (VPD), (b –e) leaf net photosynthesis (An), (f –i) leaf stomatal conductance (Gs), (j –m) leaf transpiration (E), and (n –q) leaf water potential (LWP) on 19 July in maize in 2018 after irrigation at the rainfed (P2) and irrigated (P3) plots of the stony soil (F1) and silty soil (F2). Measurement was carried out from shaded leaf (plus symbol with line) and two sunlit leaves (solid dot - lines and solid square -lines). Crop was irrigated on 18 July at 1 PM, 1 PM, 4 PM for F1P3, F2P3, and F1P2, respectively (22.75 mm for each plot) (Figure.S2).

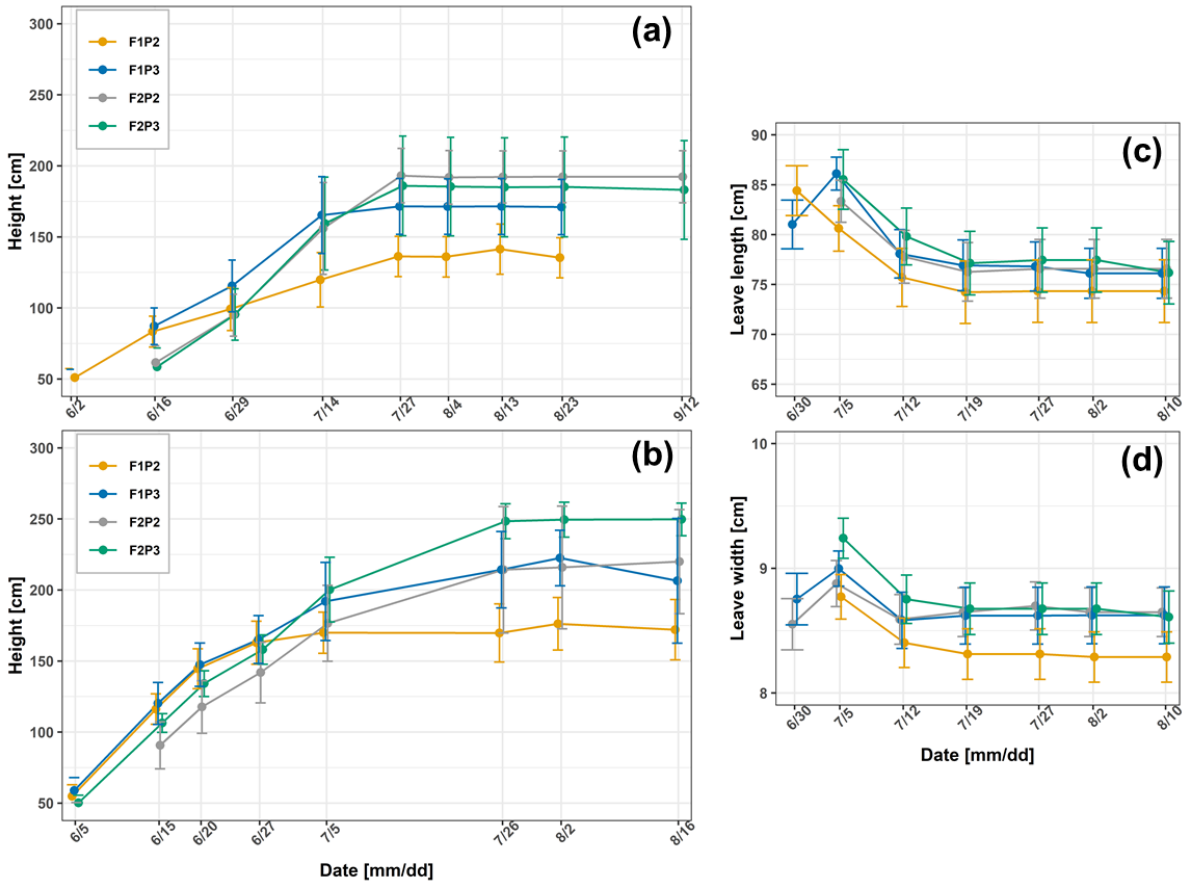

Figure S6: Dynamics of (a, b) plant height for 2017 and 2018, respectively while (c, d) are leaves length and leaves width, respectively in 2018 from the rainfed (P2) and irrigated (P3) plots of the stony soil (F1) and silty soil (F2).

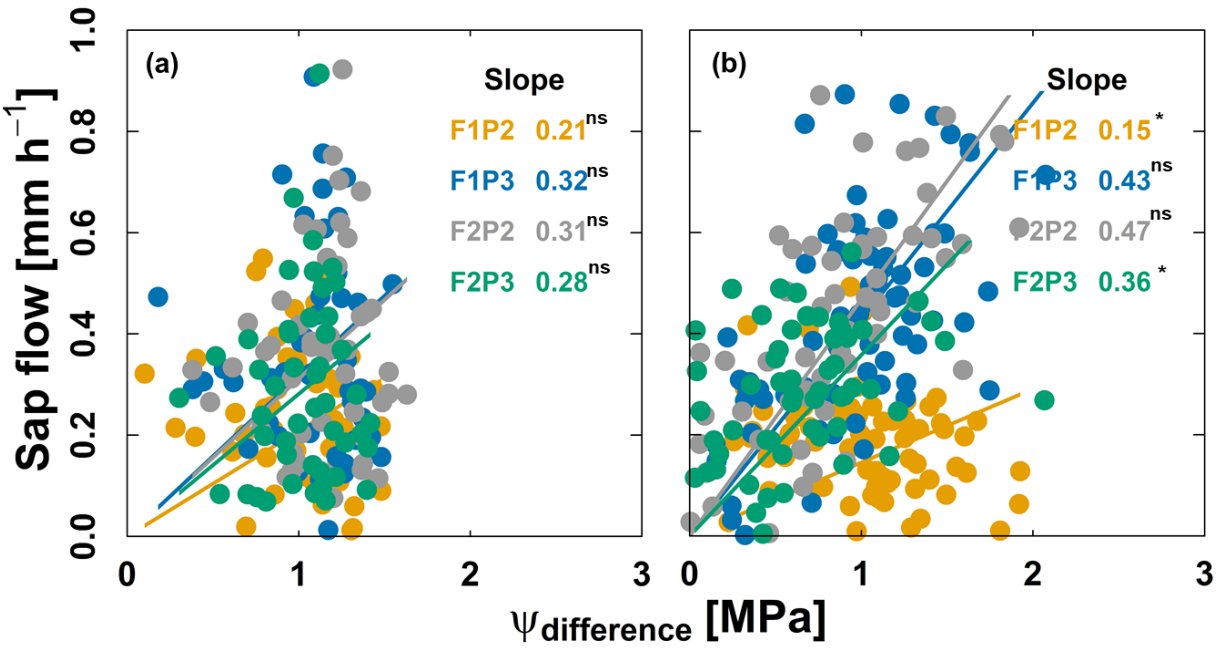

Figure S7: Relationship of sap flow and difference of effective soil water potential (ψ_{soil_effec}) and sunlit leaf water potential ($\psi_{difference}$) from measured dates from the rainfed (P2) and irrigated (P3) plots of the stony soil (F1) and silty soil (F2) in the two growing seasons (a) 2017 and (b) 2018. The unit of slope in the linear regression is mm h^{-1} MPa^{-1}. Regression was based on the DEMING approach. The asterisk which are next to the slopes indicate a significant correlation between two variables according to Pearson method (ns: non-significant; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$).

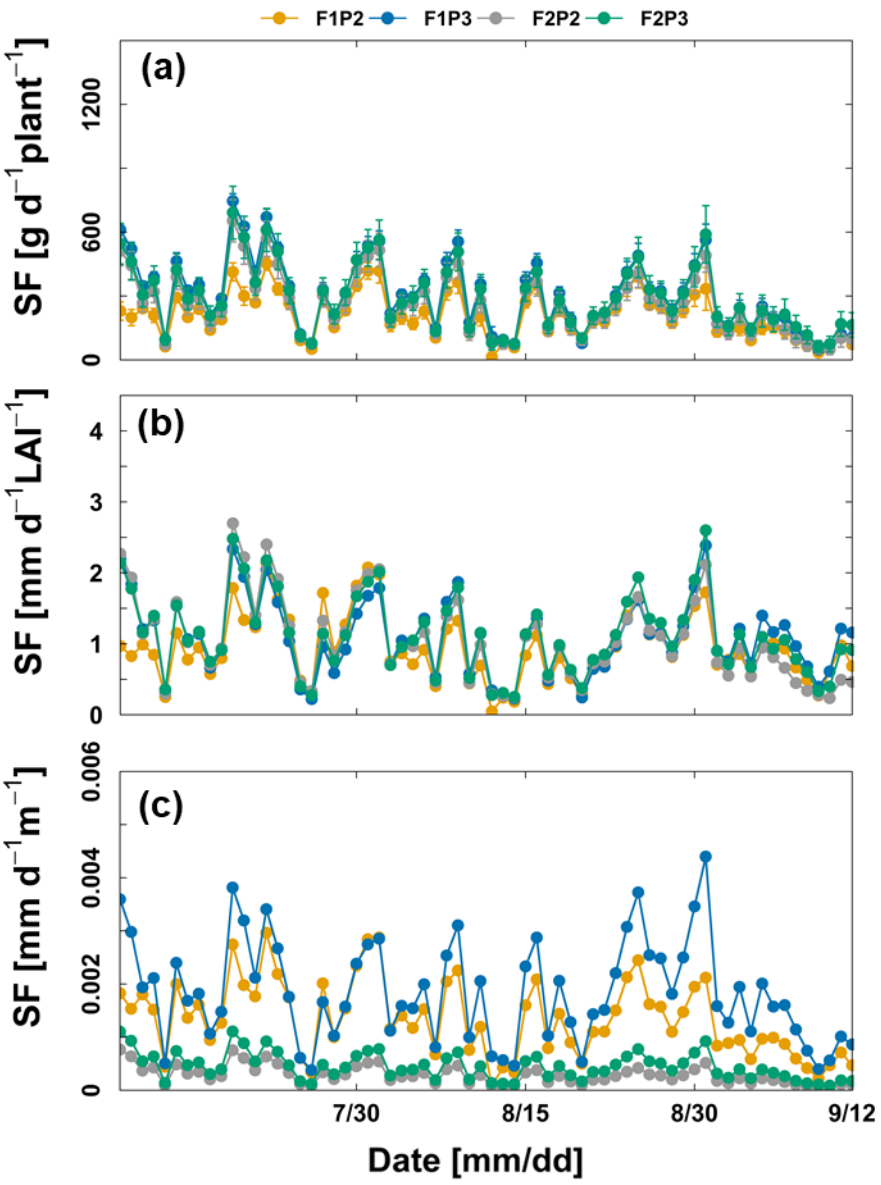

Figure S8: Comparison of sap flow (SF) in growing season 2017 from the rainfed (P2) and irrigated (P3) plots of the stony soil (F1) and silty soil (F2) with (a) sap flow per single plant (b) sap flow per leaf area index (LAI) and (c) sap flow per total root length. Data is shown from 9 July to 12 September 2017. Error bars in (a) indicate the standard deviation of the sap flow measurements in the five different maize plants.

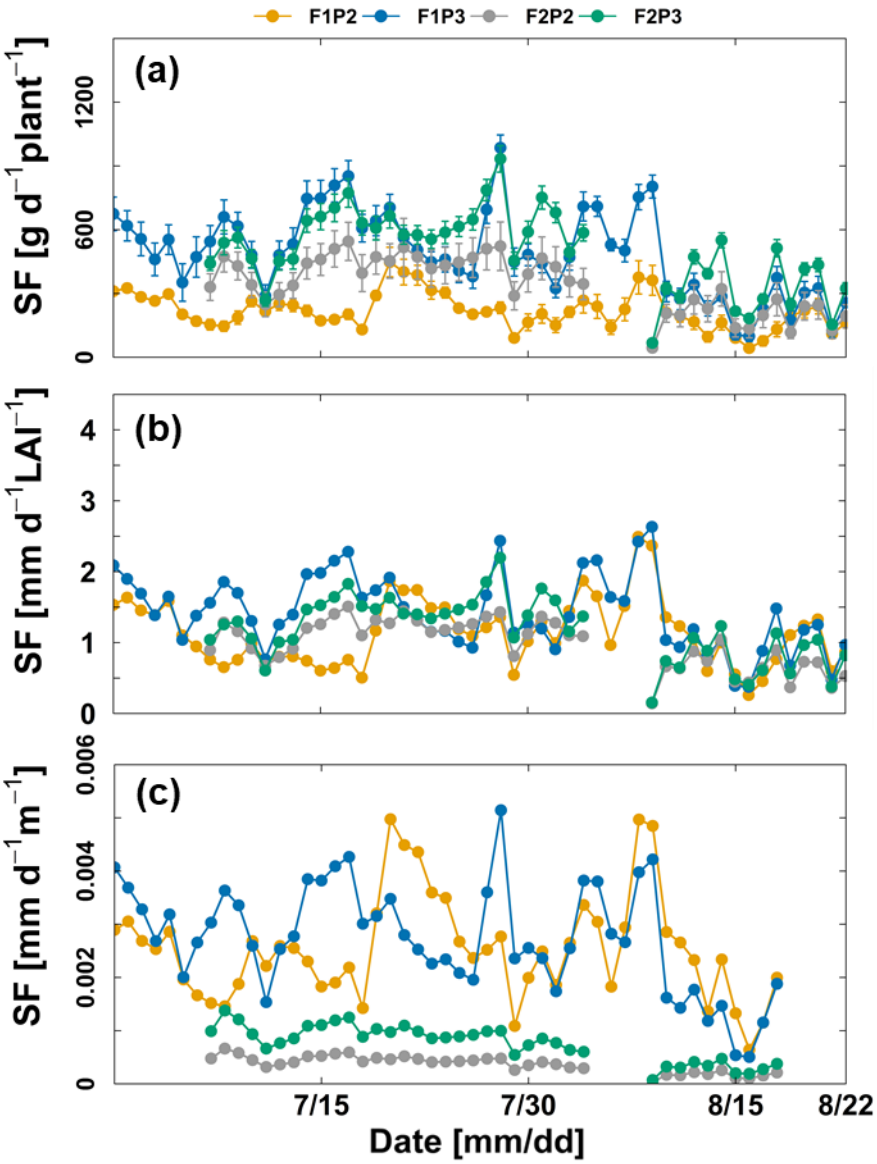

Figure S9: Comparison of sap flow (SF) in growing season 2018 from the rainfed (P2) and irrigated (P3) plots of the stony soil (F1) and silty soil (F2) with (a) sap flow per single plant (b) sap flow per leaf area index (LAI) and (c) sap flow per total root length. Data is shown in (a, b) from 29 June and 6 July for the stony soil (F1) and silty soil (F2), respectively to 21 August, 2018. Missing values of the beginning of the growing season and from 3 August to 6 August 2018 in the F2P2 and F2P3 were due to the missing values of measured sap flow because of sensor disconnection. Missing values in (c) at the end of the growing season in F2P2 and F2P3 was due to no availability of root measurement. Error bars in (a) indicate the standard deviation of the sap flow measurements in the five different maize plants.

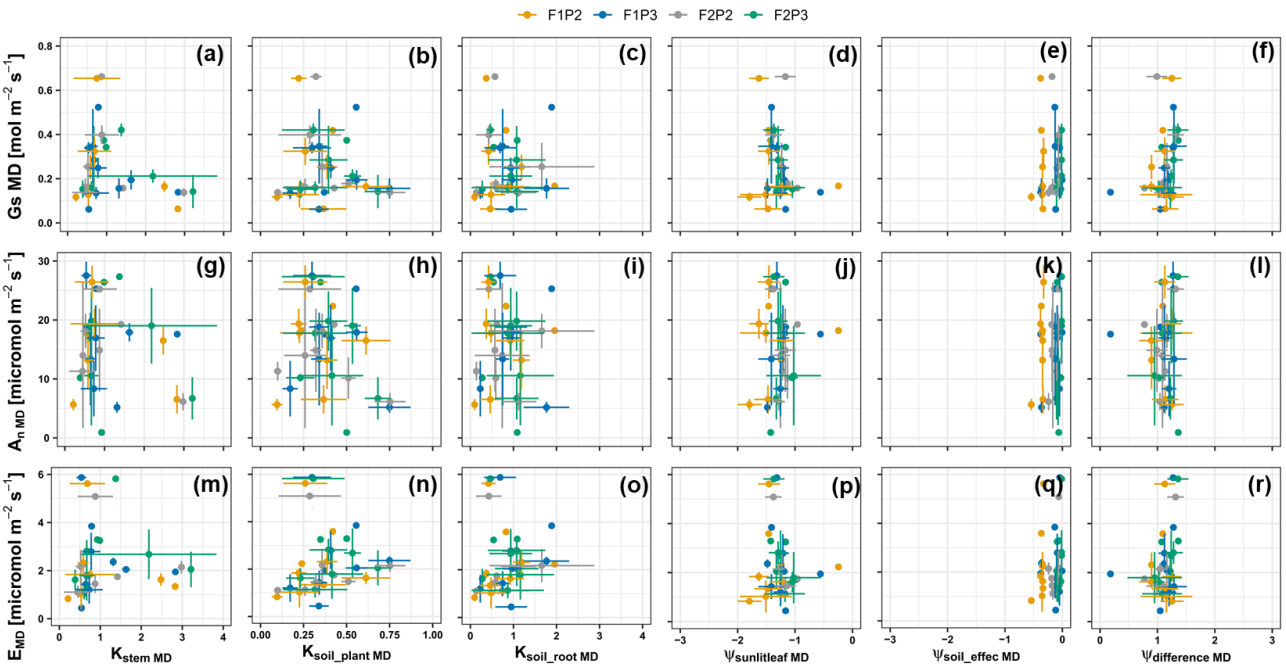

Figure S10: Relationship of midday leaf stomatal conductance (Gs MD) (top panel, a-b-c-d-e-f), photosynthesis ($A_{n\ MD}$) (middle panel, g-h-i-j-k-l), and tranpiration (E_{MD}) (bottom panel, m-n-o-p-q-r) to midday stem hydraulic conductnace ($K_{stem\ MD}$) (a-g-m), plant hydraulic conductance ($K_{soil\_plant\ MD}$) (b-h-n); soil to root hydraulic conductance ($K_{soil\_root\ MD}$) (c-i-o); sunlit leaf water potential ($\Psi_{sunlitleaf\ MD}$) (d-j-p), effective soil water potential ($\Psi_{soil\_effec\ MD}$) (e-k-q) and difference of sunlit leaf and root zone water potential ($\Psi_{difference\ MD}$) (f-l-r) from 9 measured dates from the rainfed (P2) and irrigated (P3) plots of the stony soil (F1) and silty soil (F2) in 2017. The regression was based on the DEMING approach, correlation coefficient, and significant level (pvalues) between two variables were showed in Table S1. Vertical and horizontal bars represent the standard deviation of 04 hours values at around midday (11, 12, 13, 14, LT).

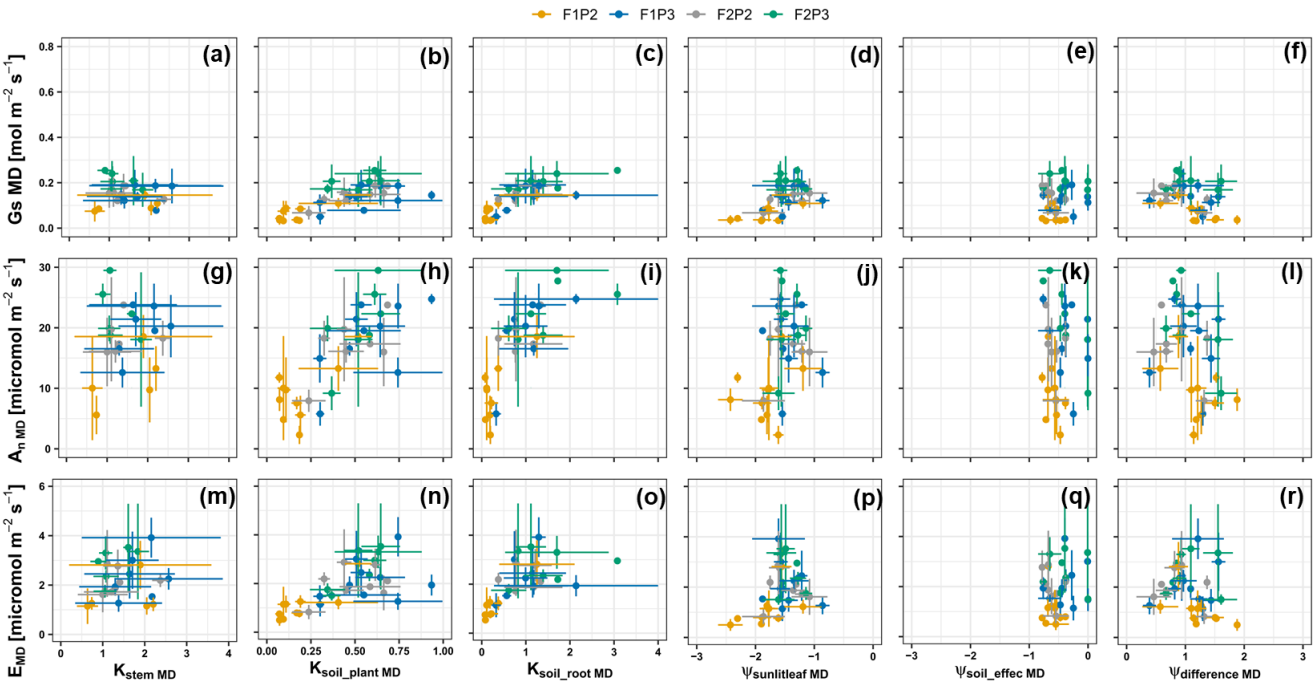

Figure S11: Relationship of midday leaf stomatal conductance (Gs MD) (top panel, a-b-c-d-e-f), photosynthesis ($A_{n\ MD}$) (middle panel, g-h-i-j-k-l), and tranpiration (E_{MD}) to midday stem hydraulic conductnace ($K_{stem\ MD}$) (a-g-m), plant hydraulic conductance ($K_{soil\_plant\ MD}$) (b-h-n); soil to root hydraulic conductance ($K_{soil\_root\ MD}$) (c-i-o); sunlit leaf water potential ($\Psi_{sunlitleaf\ MD}$) (d-j-p), effective soil water potential ($\Psi_{soil\_effec\ MD}$) (e-k-q) and difference of sunlit leaf and root zone water potential ($\Psi_{difference\ MD}$) (f-l-r) from 9 measured dates from the rainfed (P2) and irrigated (P3) plots of the stony soil (F1) and silty soil (F2) in 2018. The regression was based on the DEMING approach, correlation coefficient, and significant level (pvalues) between two variables were showed in Table S1. Vertical and horizontal bars represent the standard deviation of 04 hours values at around midday (11, 12, 13, 14, LT).

Table S1. Summary of statistical analysis of dependent variables (midday stomatal conductance – Gs MD, midday leaf photosynthesis – An_{MD}, midday leaf transpiration – E_{MD}) with independent variables (stem hydraulic conductance – K_{stem}, whole plant hydraulic conductance – K_{soil_plant}, root system hydraulic conductance – K_{soil_root}, midday sunlit leaf water potential – $\psi_{sunlitleaf\ MD}$, midday effective soil water potential – $\psi_{soil\_effec,\ MD}$, difference of water potential between root zone and sunlit leaf water potential – $\psi_{difference,\ MD}$) for F1 (stony soil), F2 (silty soil), and P2 (rainfed), and P3 (irrigated) for two growing seasons 2017 (n = 9 days, Figure S10 and Fig. 6) and 2018 (n = 10 days, Figure S11 and Fig. 7). Statistical indexes r is correlation coefficient and pvalue. Bold values indicate the significantly correlation between dependent and independent variables at the probability level of $p < 0.05$.

		2017								2018							
		F1P2		F1P3		F2P2		F2P3		F1P2		F1P3		F2P2		F2P3	
Dependent variable	Independent variable	r	pvalue	r	pvalue	r	pvalue	r	pvalue	r	pvalue	r	pvalue	r	pvalue	r	pvalue
Gs_{MD}	$K_{stem\ MD}$	-0.23	0.58	-0.32	0.401	-0.22	0.6	-0.28	0.458	0.29	0.445	0.4	0.29	-0.31	0.499	-0.58	0.226
	$K_{soil\_plant\ MD}$	-0.1	0.812	0.15	0.7	-0.25	0.558	-0.18	0.642	**0.79**	**0.011**	0.48	0.196	0.74	0.059	0.72	0.110
	$K_{soil\_root\ MD}$	-0.06	0.887	-0.24	0.526	-0.05	0.912	0.02	0.968	**0.77**	**0.016**	0.15	0.702	0.2	0.669	**0.9**	**0.015**
	$\Psi_{sunlitleaf\ MD}$	-0.11	0.8	-0.44	0.238	-0.38	0.354	-0.29	0.444	0.58	0.098	0.29	0.451	-0.03	0.943	-0.13	0.804
	$\psi_{soil\_effec\ MD}$	0.2	0.63	0.24	0.536	0.3	0.472	0.19	0.622	-0.24	0.54	0.09	0.811	-0.85	0.014	-0.63	0.18
	$\Psi_{difference\ MD}$	0.15	0.731	0.44	0.238	0.44	0.276	0.32	0.402	**-0.7**	**0.037**	-0.19	0.628	-0.35	0.439	-0.36	0.48
An_{MD}	$K_{stem\ MD}$	-0.29	0.49	-0.13	0.734	-0.39	0.339	-0.11	0.78	-0.02	0.962	0.25	0.51	0.05	0.921	-0.47	0.352
	$K_{soil\_plant\ MD}$	0.06	0.887	-0.17	0.668	-0.44	0.271	-0.46	0.215	0.65	0.056	0.59	0.094	0.35	0.442	0.52	0.291
	$K_{soil\_root\ MD}$	0.2	0.635	0.05	0.905	-0.07	0.878	-0.46	0.212	**0.72**	**0.028**	0.4	0.289	-0.22	0.64	0.61	0.199
	$\Psi_{sunlitleaf\ MD}$	0.25	0.547	0.13	0.743	-0.07	0.876	0.05	0.895	0.23	0.55	-0.21	0.579	-0.41	0.357	-0.33	0.52
	$\psi_{soil\_effec\ MD}$	0.56	0.145	0.38	0.318	0.38	0.35	0.29	0.441	-0.45	0.225	-0.19	0.628	-0.62	0.134	-0.75	0.086
	$\Psi_{difference\ MD}$	-0.18	0.673	0.05	0.907	0.23	0.586	0.03	0.948	-0.43	0.25	0.06	0.876	0.06	0.899	-0.33	0.526
E_{MD}	$K_{stem\ MD}$	-0.15	0.726	-0.16	0.686	-0.16	0.71	0.11	0.77	0.26	0.492	0.42	0.257	0.09	0.841	0.56	0.248
	$K_{soil\_plant\ MD}$	0.02	0.968	0.12	0.76	0.04	0.926	-0.1	0.8	**0.81**	**0.008**	0.25	0.522	-0.2	0.662	0.77	0.071
	$K_{soil\_root\ MD}$	0.07	0.865	-0.1	0.789	0	0.998	-0.29	0.443	**0.94**	**0**	0.39	0.299	-0.47	0.288	0.22	0.669
	$\Psi_{sunlitleaf\ MD}$	0.13	0.761	-0.22	0.562	-0.54	0.166	-0.61	0.084	0.41	0.27	-0.2	0.602	**-0.77**	**0.042**	**-0.91**	**0.012**
	$\psi_{soil\_effec\ MD}$	0.43	0.282	0.15	0.695	0.31	0.448	0.45	0.224	-0.15	0.695	0.34	0.367	-0.37	0.413	0.21	0.692
	$\Psi_{difference\ MD}$	-0.07	0.872	0.24	0.541	0.58	0.135	0.68	0.046	-0.49	0.184	0.4	0.283	0.47	0.293	0.68	0.141