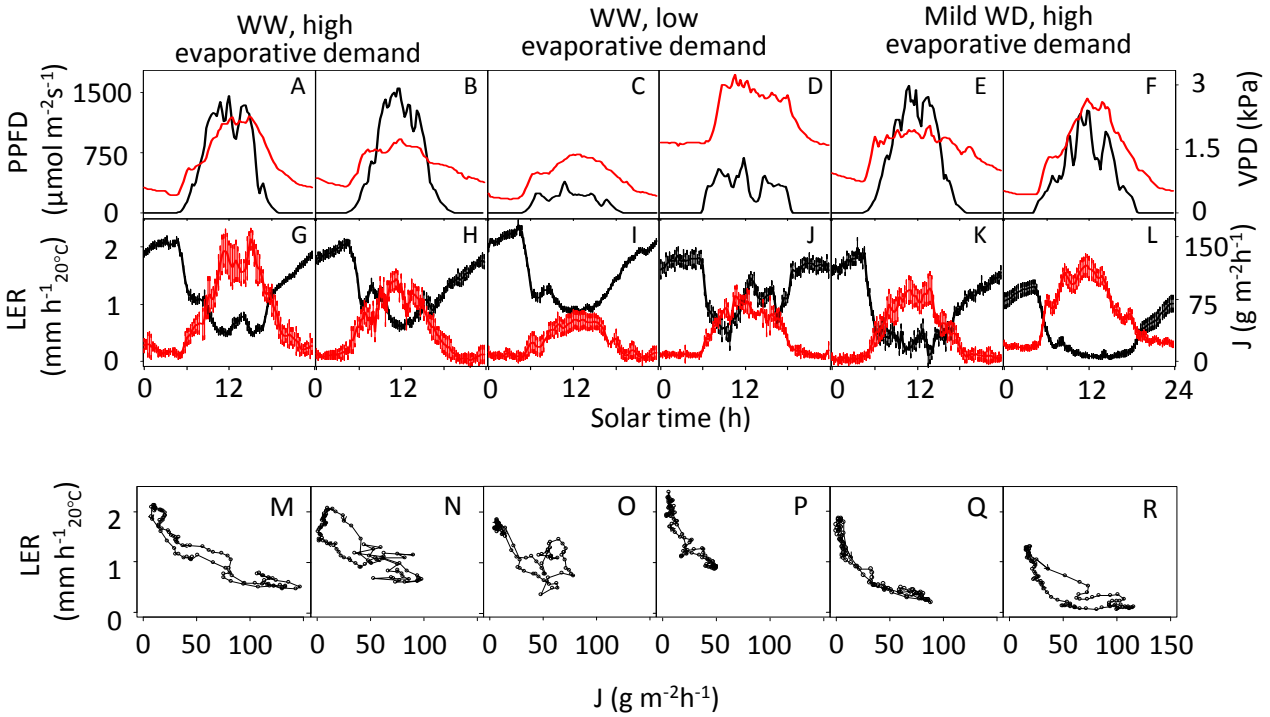
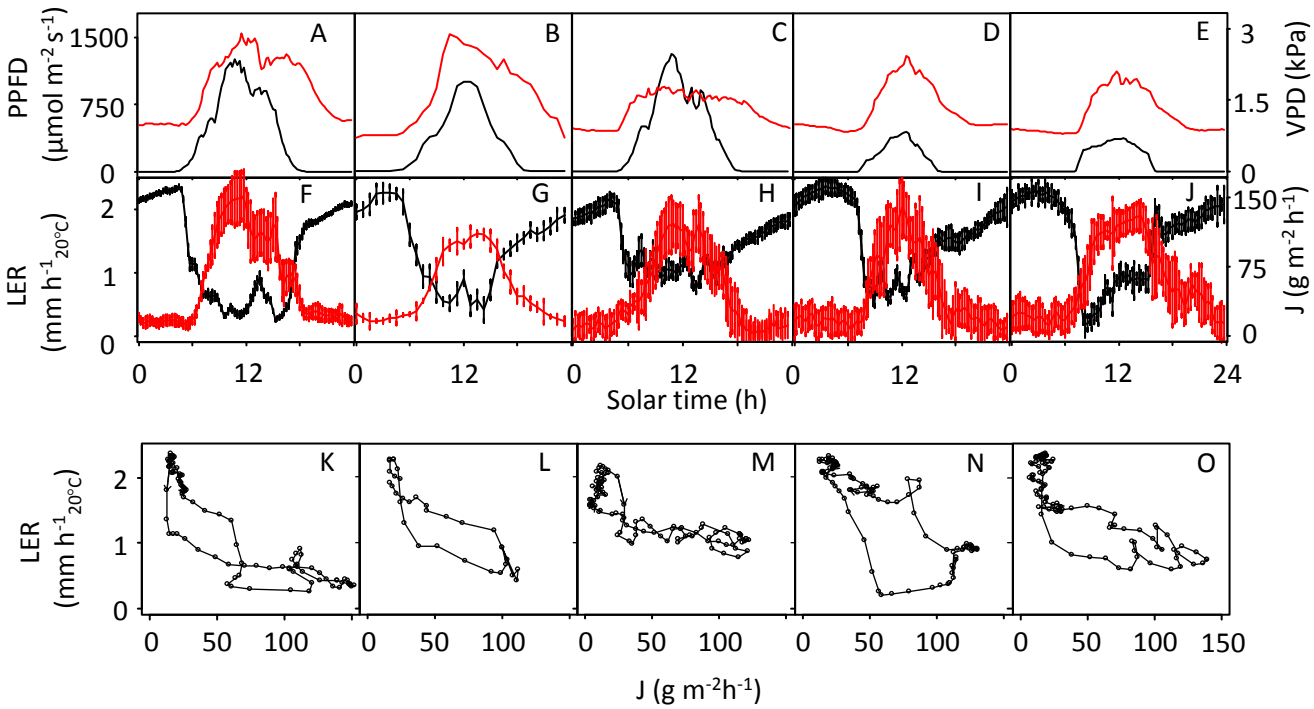
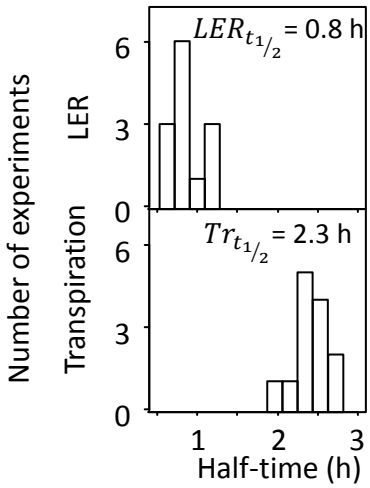


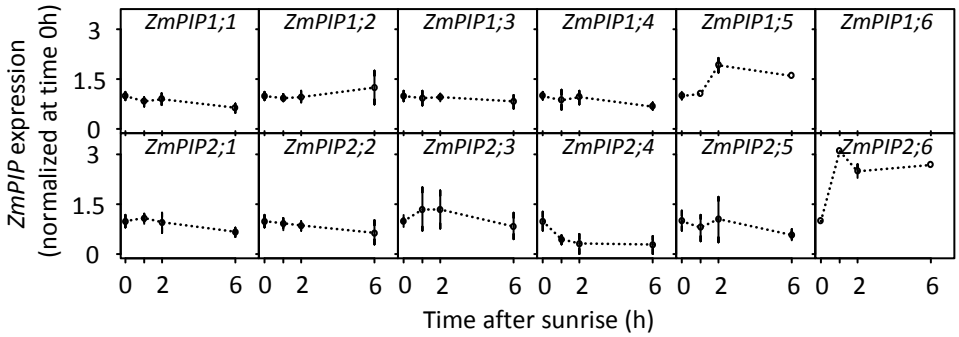
Supplementary Fig. 1. (panels A-L common to Fig. 1 main text, for better legibility of panels M-R) Daily time courses of environmental conditions, transpiration (J) and leaf elongation rate (LER) and the relationship between LER and E in six groups of experiments. Panels A, B, G, H, M and N, experiments 8 and 11 (82 and 149 time courses, respectively) with well watered plants and high evaporative demand. Panels C, D, I, J, O and P, experiments 9 and 19 (152 and 76 time courses, respectively) with well watered plants and low evaporative demand. Panels E, F, K, L, Q and R, experiments 6 and 7 (93 and 81 time courses, respectively) with very mild water deficit (soil water potential of -0.15±0.05 and -0.3±0.05 MPa) and high evaporative demand. Panels A-F: red, air vapour pressure deficit (VPD); black photosynthetic photon flux density (PPFD). Panels G-L: red, J; black, LER. Error bars, confidence interval at $p<0.05$



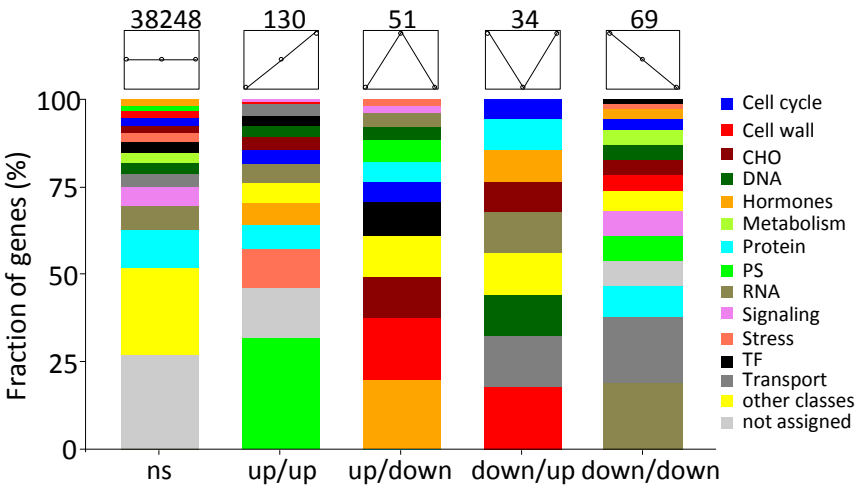
Supplementary Fig. 2. Daily time courses of environmental conditions, transpiration (J) and leaf elongation rate (LER) and the relationship between LER and J in five groups of experiments. Panels A, B, F, K and L, experiments 21 and 22 (259 and 40 time courses, respectively) with well watered plants and high evaporative demand. Panels C, H and M, experiments 13 (48 time courses) with well watered plants and low evaporative demand. Panels D, E, I, J, N and O, experiments 15 and 16 (40 and 48 time courses, respectively) with well watered plants performed during the long winter nights. Panels A-E: red, air vapour pressure deficit (VPD); black photosynthetic photon flux density (PPFD). Panels F-J: red, J; black LER. Error bars, confidence interval at $p<0.05$



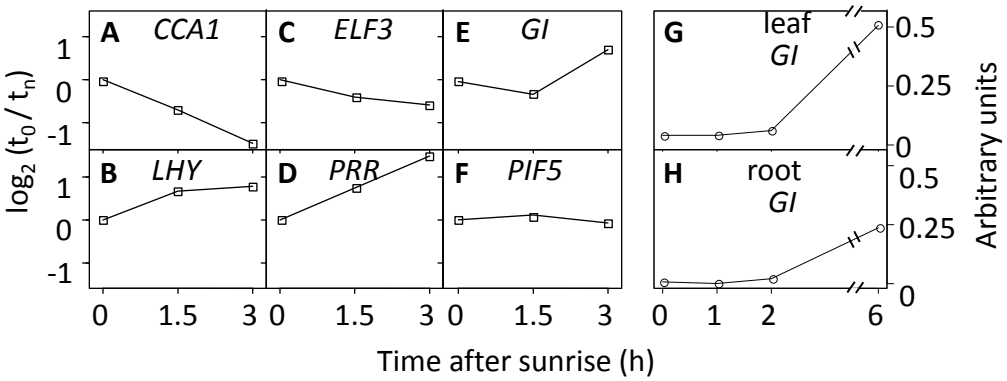
Supplementary Fig. 3. Half-times of reductions in leaf elongation rate and of increase in transpiration during the morning in 13 experiments (6 to 16, 20 and 22; SI Table 1).



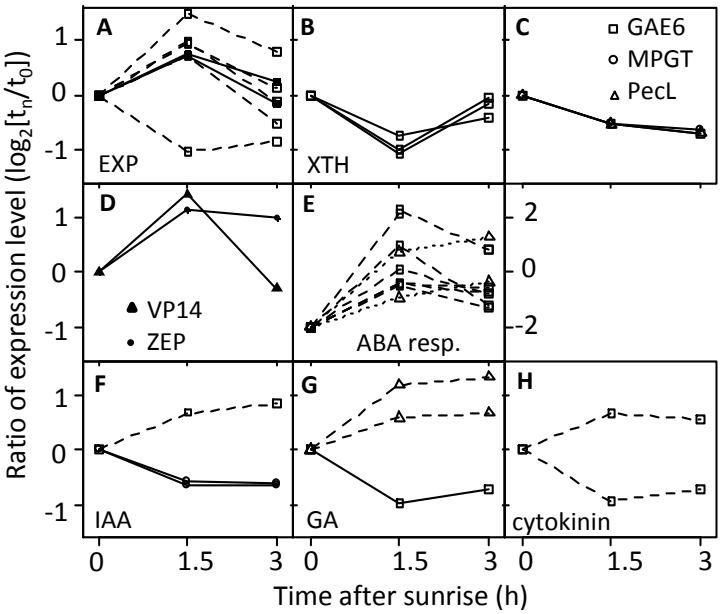
Supplementary Fig. 4. Expression levels (measured by quantitative RT-PCR) of 12 *ZmPIP* genes in the leaf growth zone during the morning. Samples were collected from plants grown in soil substrate (Exp 6 in Table 1) under mild water deficit (-0.15 MPa) along the morning (30 before [0h] dawn and 1,2 and 6 hours after sunrise). The geometric mean of the expression level of three control genes (ACT1, EF1-a and polyubiquitin) was used to normalize the data. Each point, mean value (n = 3-5). Error bars, confidence intervals ($p<0.05$). A star indicate significant variation ($p<0.05$) of expression levels related to time 0h in a Kruskal-Wallis test.



Supplementary Fig. 5. Overview of the genome-wide transcriptome analysis performed in the growing zone of leaves of the génotype B73 sampled 30 before dawn (first point in the boxes), 1h30 and 3 hours after sunrise (Exp. 6) . Cluster of genes with (i) non-significant trend (ns), (ii) continuous increase (up/up) (iii) fast increase after 1h30 followed by decrease after 3h (up/down), (iv) opposite pattern (down/up) and (v) continuous decrease (down/down). The numbers above each pattern stand for the number of putative genes in each category. Colors in bars represent the categories of genesfollowing the ontology in MapMan.



Supplementary Fig. 6. Time courses of the ratio of expression levels of the core oscillator genes in the leaf growing zone (A-G) and roots (H) of plants of the genotype B73 grown in soil substrate (experiment 6 in Table 1) under mild water deficit (soil water potential, -0.15±0.05 MPa). Genome-wide transcriptome (A-F) and quantitative RT-PCR (GH) analysis of: A, CIRCADIAN CYCLE ASSOCIATED 1 (CCA1); B, LATE ELONGATED HYPOCOTYL (LHY); C, EARLY FLOWERING 3 (ELF3); D, PSEUDO RESPONSE REGULATOR (PRR); EGH, GIGANTEA (GI); F, PHYTOCHROME INTERACTING FACTOR 5 (PIF5). Ratio of expression level at a given time (t_n) to the reference level at time 0h (30 minutes before dawn) was defined as $\log_2(t_n/t_0)$ in the genome-wide transcriptome analysis (A-F).



Supplementary Fig. 7. Patterns of ratio of expression level of genes associated with cell wall expansion (ABC), phytohormones biosynthesis and phythormone response (D-H). Ratio of expression level at a given time (t_n) to the reference level at time 0h (30 minutes before dawn). A, seven putative expansin genes (plain lines, expansin a4 and b2; dotted lines, other putative expansins). B, two putative genes encoding xyloglucan endotransglucosylase/hydrolase (XTH). C, three putative cell wall expansion genes : squares, UDP-glucuronate 4-epimerase 6; circles, mannose-1-phosphate guanyltransferase; triangles, Pectate lyase. D, two abscisic acid (ABA) biosynthesis genes: triangles, *vp14*; circles, zeaxanthin epoxidase . E, eight ABA responsive genes. F, two auxin (IAA) bionsynthesi s (plain lines) and one IAA responsive genes (dotted line). G, one gibberelin (GA) biosynthesis (GA-20, plain line) and two GA responsive genes (dotted lines). H, Two putative genes encoding cytokinin-activating proteins.

Supplementary Table 1. Environmental conditions and lines used in the twenty three experiments realized in the Phenodyn platform. Mean half times of the time courses of leaf elongation rate ($t_{1/2LER}$) and transpiration ($t_{1/2J}$) during changes in the early morning

Exp	Genotypes	Place	Growing medium	T^a_{min}/T^a_{max} (°C)	VPD_{max} (kPa)	PPFD ($\mu mol\ m^{-2}s^{-1}$)	$t_{1/2LER}$ (h)	$t_{1/2J}$ (h)
1	NCED (AS, WT, S)	GH	S	22/30	2.2	900	-	-
2-4	B73	GC	S	28	2.8	600	-	-
5	B73	GH	H	18/27	2.7	800	-	-
6	B73	GH	S	19/29	2.3	1100	0.75	2.37
7	B73	GH	S	18/30	2.7	1500	1.25	2.13
8	B73	GH	S	18/30	2.5	1400	0.75	3.00
9	B73	GH	S	18/29	1.2	200	0.87	2.75
10	B73	GH	S	18/28	2.3	1400	1.00	2.75
11	B73	GH	S	18/29	3	1500	0.87	2.25
12	B73	GH	S	17/30	2	1200	0.75	3.12
13	B73	GH	S	18/31	2.4	1300	0.50	2.12
14	B73	GH	S	18/32	2.1	1200	0.75	1.5
15	B73	GH	S	15/30	2.3	500	0.50	1.38
16	B73	GH	S	15/30	2.4	500	0.62	1.75
17	B73	GH	S	21/28	2.8	450	-	-
18	B73	GH	S	20/27	3.1	500	-	-
19	B73	GH	S	19/30	3	550	-	-
20	B73	GH	S	20/25	2.4	750	1.25	2.38
21	B73	GH	S	20/31	2.8	1100	-	-
22	B73	GH	S	22/31	2.2	1200	1.12	2.25
23	B73	GH	S	20/30	3	1500	-	-

GH: greenhouse, GC: growth chamber, S: soil, H: hydroponics.