1 Article title: The AP2/ERF transcription factor TOE4b regulates photoperiodic

2 flowering and grain yield per plant in soybean

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4 Chen, Hui Yang, Yuhang Zhang, Baohui Liu*, Fanjiang Kong*, Xiaohui Zhao*

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6 Supporting Information:

7 Supporting figures:

8 Figure S1 Genome-wide averaged distance of linkage disequilibrium decayed.
9 Calculation via squared correlations of allele frequencies (r²) against the distance
10 between polymorphic sites in wild soybeans, landraces and cultivars.

Figure S2 Expression of 15 genes in the linkage disequilibrium block in the leaves and stem tips. (a) Data are from transcriptomic analysis in wild-type W82. The values represent RPKM value of genes in transcriptome. Data are presented as means ± SD of two biological replicates. (b) Data are from Phytozome 13 (https://phytozomenext.jgi.doe.gov/). FPKM (Fragments Per Kilobase of exon model per Million mapped reads).

Figure S3 Natural variation of *TOE4b*. (a) Summary of *TOE4b* haplotypes across a diversity panel comprising 1,744 soybean accessions. (b) Origin tree of the *TOE4b* haplotypes. The data are from 1,744 accessions, consisting of 221 wild soybeans, 516 landraces, and 874 improved cultivars. The red arrows indicate the direction of evolution.

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(a, b) Flowering time of six allelic combinations between *TOE4b* and *E2* across 449
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Figure S8 Agronomic traits associated with the major haplotypes of TOE4b. 49 Agronomic trait of plant height (a), measured from the cotyledonary node of the main 50 51 stem to the apex in centimeters; number of nodes (b); average of internode length (c); branch number per plant (d); pod number per plant (e); and grain weight per plant (f). 52 $TOE4b^{HI}$, n = 68; $TOE4b^{H4}$, n = 83. The plants were grown in a standard field in Harbin 53 under natural conditions in 2017. At least 6 plants were scored for each phenotype; data 54 are means \pm SD. P < 0.05, two-tailed Student's *t*-test. Different lowercase letters 55 indicate significant differences. 56

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58 Supporting tables:

59 **Table S1** Significant loci associated with flowering time identified through GWAS.

60	Table S2	The $-\log_{10}(p)$	values	of significant	loci associat	ed with	flowering	time :	for
				0			0		

61 GWAS.

- 62 **Table S3** Information of candidate genes within LD block.
- 63 **Table S4** Transcription levels of the 15 genes in the leaves and stem tips.
- 64 **Table S5** List of soybean accessions used for GWAS.
- 65 **Table S6** Primers used in this study.

\sim	\sim
h	h
v	v

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(a)	Reference Genome W82		Haplotype								Number	
	TOE4b	H1	G	Т	G	С	G	С	С	A	С	1189
		H2	G	А	G	А	G	С	С	Α	С	69
		H3	G	Т	А	С	G	С	С	Α	С	52
		H4	G	Т	G	С	А	С	С	Α	С	283
		H5	С	Т	G	А	G	С	С	А	С	4
		H6	G	А	G	А	G	С	С	С	С	1
		H7	G	Т	G	С	G	А	С	A	С	1
		H8	G	Т	G	С	G	С	A	А	С	1
		H9	G	Т	G	С	G	С	С	С	С	6
		H10	G	Т	G	С	G	С	С	A	А	5
	CDS nt # in W82		245	283	306	328	715	841	848	958	1086	
	AA # in W82		82	95	102	110	239	281	283	320	362	
	AA identified in W82		S	F	M	Н	G	Р	A	N	F	
	AA cha	ange	Т	I	I	N	S	Т	D	Н	L]



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A	Ρ2

(a)			
LOC_0s07g13170.2 LOC_0s05g03040.1_0sAP2D23 LOC_0s04g55560.2 AT4G36920.1_AtAP2 AT3G67180.1_At7OE3 AT2G28550.3_AtTOE1 Medtr4g081200.2 Medtr2g093060.1 Medtr2g093060.1 Medtr2g093060.1 Phvul.003G241900.1 Phvul.003G241900.1 Phvul.001G174400.1 Glyma.03G177500.1_GmTOE1a Glyma.03G177500.1_GmTOE1a Glyma.03G091200.1_GmTOE2a Glyma.01G083800.1_GmTOE2a Glyma.01G188400.1_GmTOE2b Glyma.12G073300.1_GmTOE3b Glyma.12G073300.1_GmTOE4b Glyma.13G329700.1_GmTOE4b-H1 Glyma.13G329700.1_GmTOE4b-H1	260 * 280 RGPRSRSSQYRGVTFYRNGRNESHIND RGPRSRSSQYRGVFFYRNGRNESHIND RGPRSRSSQYRGVFFYRNGRNESHIND RGPRSRSSQYRGVFFYRNGRNESHIND RGPRSRSSQYRGVFFYRNGRNESHIND RGPRSRSSQYRGVFFYRNGRNESHIND RGPRSRSSQYRGVFFYRNGRNESHIND RGPRSRSSQYRGVFFYRNGRNESHIND RGPRSRSSQYRGVFFYRNGRNESHIND RGPRSRSSQYRGVFFYRNGRNESHIND RGPRSRSSQYRGVFFYRNGRNESHIND RGPRSRSSQYRGVFFYRNGRNESHIND RGPRSRSSQYRGVFFYRNGRNESHIND RGPRSRSSQYRGVFFYRNGRNESHIND RGPRSRSSQYRGVFFYRNGRNESHIND RGPRSRSSQYRGVFFYRNGRNESHIND RGPRSRSSQYRGVFFYRNGRNESHIND RGPRSRSSQYRGVFFYRNGRNESHIND RGPRSRSSQYRGVFFYRNGRNESHIND RGPRSRSSQYRGVFFYRNGRNESHIND RGPRS	300 CKCVVI GGEDTAH AARAYDRAAIKFRGU GKCVVI GGEDTAH AARAYDRAAIKFRGU	ADINENI NYEL DIKO KAN KEEV : 19 ADINENI NYEL DIKO KAN KEISKEEV : 24 ADINENI SYEEDIKO KAN KEISKEEV : 24 ADINENI SYEEDIKO KAN KEEV : 20 ADINENI SYEEDIKO KAN KEEV : 20 ADINENI SYEEDIKO KAN SKEEV : 22 ADINENI SYEEDIKO KAN SKEEV : 22 ADINENI SYEEDIKO KAN SKEEV : 21 ADINENI SYEEDIKO KAN SKEEV : 21 ADINENI SYEEDIKO KAN SKEEV : 22 ADINENI SYEEDIKO SAITKEEV : 23 ADINENI SYEEDIKO SAITKEEV : 21 ADINENI SYEEDIKO SAITKEEV : 23 ADINENI SYEEDIKO SAITKEEV : 21 ADINENI SYEEDIKO SAITKEEV : 21
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