

**Supplementary data:**

**Table 1.** QTL for tassel related traits of F<sub>2:3</sub> population across and RIL population through single-environment analysis (SEA).

Trait	Population type	Environment	QTL	Binlocus <sup>a</sup>	Flanking marker	Peak position (cM)	Range (cM) <sup>b</sup>	A <sup>c</sup>	D <sup>d</sup>	Gene action <sup>e</sup>	R <sup>2</sup> (%) <sup>f</sup>	Subtotal R <sup>2</sup> (%) <sup>g</sup>	F(0.05) <sup>h</sup>		
TTL	F <sub>2:3</sub>	2012NN	<i>qTTL-2-3</i>	2.07	<i>SYN5428/PZE-102146058</i>	178.8	168.5–188.9	-1.2758**	-0.0244	A	8.49	8.49	8.97		
			<i>qTTL-1-3</i>	1.09/1.10	<i>PZE-101213558/PZE-101219724</i>	275.1	270.7–278.8	-1.7978**	-0.4927	A	16.29			28.16	
		2012YA	<i>qTTL-2-3</i>	2.07	<i>SYN5428/PZE-102146058</i>	179.8	168.5–182.3	-1.6038**	-0.1469	A	11.87	11.18	9.03		
			<i>qTTL-1-3</i>	1.09/1.10	<i>PZE-101213558/PZE-101219724</i>	276.1	270.7–279.8	-1.4728**	0.7767*	PD	11.18				
			<i>qTTL-1-3</i>	1.09/1.10	<i>PZE-101213558/PZE-101219724</i>	275.1	265.7–278.8	-1.6159**	0.6206	A	13.79			13.79	9.17
		2012JH	<i>qTTL-1-3</i>	1.09/1.10	<i>PZE-101213558/PZE-101219724</i>	275.1	268.7–280.1	-0.8524**	-0.1499	A	8.52	32.69	8.75		
			<i>qTTL-2-2</i>	2.07	<i>PZE-102125779/PZE-102131295</i>	166.5	161.1–174.8	-1.2485**	0.1176	A	10.39				
		2013JH	<i>qTTL-6-2</i>	6.02	<i>PZE-106038186/PZE-106041751</i>	41.3	37.1–44.3	-0.9028**	0.6204*	PD	7.61	29.72	8.85		
			<i>qTTL-7-2</i>	7.04	<i>PZE-107098219/PZE-107098286</i>	144.4	128.1–148.4	-0.5619**	0.3176	A	6.17				
			<i>qTTL-1-1</i>	1.01	<i>SYN10708/SYN14143</i>	24.6	17.4–34.6	-0.9003**	-0.1678	A	4.94				
		RIL	2014JH	2015JH3	<i>qTTL-1-3</i>	1.09/1.10	<i>PZE-101213558/PZE-101219724</i>	277.1	272.1–279.8	-1.2758**	0.1549	A	11.36	32.73	14.72
					<i>qTTL-2-3</i>	2.07	<i>SYN5428/PZE-102146058</i>	179.8	175.1–180.3	-1.3053**	0.225	A	10.29		
					<i>qTTL-6-3</i>	6.04	<i>PZE-106055082/PZE-106058910</i>	67.6	52.4–72.6	-0.7677**	-0.0519	A	3.13		
				<i>qTTL-1-2</i>	1.01	<i>SYN14143/PZE-101019726</i>	5.3	2.3–9.3	-1.1596**		A	8.64			
				<i>qTTL-2-3</i>	2.07	<i>PZE-102145703/PZE-102146058</i>	133.3	132.3–133.5	-1.4088**		A	16.06			
<i>qTTL-3-1</i>	3.08/3.09			<i>PZE-103163529/PZE-103165581</i>	179	178.0–183.6	-0.7877**		A	8.03					
2015JH4	<i>qTTL-3-1</i>	3.08/3.09	<i>PZE-103163529/PZE-103165581</i>	183	178.0–183.6	-1.4014**		A	9.89	16.58	13.95				
	<i>qTTL-5-2</i>	5.06	<i>PZE-105141465/PZE-105156713</i>	158	151.0–158.8	0.6944**		A	1.57						
	<i>qTTL-6-1</i>	6.01	<i>PZE-106025164/PZE-106029942</i>	23.8	22.8–24.0	-0.8428**		A	5.12						
2015JH4	<i>qTTL-1-2</i>	1.01	<i>SYN14143/PZE-101019726</i>	4.3	2.3–8.3	-1.23**		A	9.26	17.22	14.35				
	<i>qTTL-3-1</i>	3.08/3.09	<i>PZE-103163529/PZE-103165581</i>	183	179.0–183.6	-1.089**		A	7.96						

TBN	F <sub>2,3</sub>	2012NN	<i>qTBN-1-4</i>	1.11	<i>PZE-101242961/SYN11155</i>	300.6	300.5–304.6	-0.5217**	-0.6388*	PD	9.32	45.1	8.87
			<i>qTBN-1-6</i>	1.11	<i>SYN12789/PUT-163a-76012177-3730</i>	320.8	312.8–325.0	-0.5459**	0.7821*	PD	9.09		
			<i>qTBN-2-6</i>	2.04	<i>PZE-102056295/PZE-102056669</i>	76.5	68.4–78.0	1.2609**	0.5124	A	10.37		
			<i>qTBN-4-4</i>	4.06	<i>SYN13970/PZE-104082879</i>	81.1	76.2–85.0	1.0938**	0.2788	A	10.04		
			<i>qTBN-5-3</i>	5.04	<i>PZE-105102631/PZE-105103973</i>	41.4	30.9–47.6	-0.7879**	0.3434	A	6.28		
		2013NN	<i>qTBN-2-4</i>	2.03	<i>PZE-102047571/PZE-102049280</i>	68.9	65.4–73.8	0.5352**	0.5015*	PD	7.01	30.32	8.66
			<i>qTBN-4-3</i>	4.05/4.06	<i>PZE-104073430/SYN13970</i>	79.2	75.2–85.0	1.0084**	0.5648*	PD	7.4		
			<i>qTBN-7-5</i>	7.04	<i>PZE-107095878/PZE-107097026</i>	138.4	138.2–141.4	0.4476**	-0.3281	A	7.62		
			<i>qTBN-7-8</i>	7.06	<i>PZE-107121485/PZE-107130514</i>	176	167.0–185.8	0.6551**	0.4385	A	8.29		
		2012YA	<i>qTBN-1-6</i>	1.11	<i>SYN12789/PUT-163a-76012177-3730</i>	315.8	295.5–323.0	-0.8807**	0.1421	A	10.61	29	8.89
			<i>qTBN-2-7</i>	2.05	<i>PZE-102100718/PZE-102104865</i>	123.4	114.8–125.9	0.6367**	0.298	A	5.73		
			<i>qTBN-6-3</i>	6.07	<i>SYN22989/SYN34377</i>	168.8	161.2–177.0	0.8564**	0.1679	A	8.72		
			<i>qTBN-7-3</i>	7.03	<i>PZE-107067144/PZE-107067432</i>	105.2	100.6–110.8	0.6075**	0.0278	A	3.94		
		2013YA	<i>qTBN-1-5</i>	1.11	<i>SYN11155/SYN12789</i>	307.1	300.6–321.8	-0.9965**	-0.3041	A	13.37	43.33	9.04
			<i>qTBN-2-7</i>	2.05	<i>PZE-102100718/PZE-102104865</i>	123.4	112.8–126.6	0.5981**	0.2259	A	4.77		
			<i>qTBN-5-2</i>	5.04	<i>PZE-105098019/PZE-105102631</i>	36.9	31.9–46.4	-0.8048**	-0.2168	A	10.48		
			<i>qTBN-6-3</i>	6.07	<i>SYN22989/SYN34377</i>	168.8	160.2–175.0	0.7254**	0.1642	A	8.33		
		2012JH	<i>qTBN-7-4</i>	7.03	<i>SYN19096/SYN16900</i>	133.6	129.7–137.2	0.7631**	-0.0348	A	6.38		
			<i>qTBN-1-5</i>	1.11	<i>SYN11155/SYN12789</i>	307.1	295.5–319.8	-1.0595**	-0.1115	A	10.75	45.19	8.55
			<i>qTBN-2-4</i>	2.03	<i>PZE-102047571/PZE-102049280</i>	68.9	66.4–70.8	1.2145**	0.5937*	PD	9.54		
			<i>qTBN-4-4</i>	4.06	<i>SYN13970/PZE-104082879</i>	80.1	76.2–84.1	1.0198**	-0.1887	A	8.32		
		<i>qTBN-6-2</i>	6.05	<i>PZE-106097959/PZE-106101278</i>	139.8	136.7–142.8	1.0505**	-0.0615	A	8.46			
		2013JH	<i>qTBN-7-6</i>	7.04/7.05	<i>PZE-107113723/PZE-107121485</i>	161.1	151.3–178.0	1.0529**	0.2032	A	8.12		
			<i>qTBN-1-2</i>	1.07	<i>PZE-101180375/PZE-101182552</i>	236.1	232.6–258.1	-0.5678**	-0.5522*	PD	2.61	38.91	8.85
<i>qTBN-2-5</i>	2.03/2.04		<i>PZE-102049280/SYN314</i>	71.8	68.9–80.6	1.0533**	0.3268	A	9.49				
<i>qTBN-4-4</i>	4.06		<i>SYN13970/PZE-104082879</i>	82.1	77.2–90.0	0.5248**	0.3265	A	5.26				
<i>qTBN-4-5</i>	4.09		<i>PZA02479.1/PZE-104137221</i>	157.3	147.2–161.7	0.544**	0.0471	A	4.3				
<i>qTBN-5-2</i>	5.04		<i>PZE-105098019/PZE-105102631</i>	34.9	19.3–49.6	-0.7831**	0.3403	A	7.27				

RIL	2014JH	<i>qTBN-7-4</i>	7.03	<i>SYN16900/SYN19096</i>	132.6	130.7–138.2	1.0295**	0.3132	A	9.98		
		<i>qTBN-1-3</i>	1.11	<i>SYN22772/SYN11155</i>	223.7	216.7–224.5	-0.6811**		A	3.69	51.63	13.78
		<i>qTBN-2-1</i>	2.02/2.03	<i>SYN7604/PZE-102037260</i>	24.1	17.1–28.6	1.3359**		A	15.27		
		<i>qTBN-4-2</i>	4.05	<i>PZE-104053258/PZE-104111457</i>	68.2	67.2–68.3	0.6866**		A	3.25		
		<i>qTBN-5-1</i>	5.02/5.03	<i>PZA02029.19/PZE-105032498</i>	45.9	38.9–53.9	-0.8522**		A	6.4		
	2015JH3	<i>qTBN-7-1</i>	7.02	<i>PZE-107049384/PZE-107057229</i>	65.7	61.7–66.0	0.9061**		A	9.27		
		<i>qTBN-7-7</i>	7.06	<i>PZE-107121485/PZE-107130438</i>	142.9	134.9–150.4	0.9776**		A	13.75		
		<i>qTBN-1-3</i>	1.11	<i>SYN22772/SYN11155</i>	222.7	216.7–224.5	-0.6471**		A	2.5	42.82	14.16
		<i>qTBN-2-3</i>	2.03	<i>SYN35504/PZE-102047187</i>	35	33.6–38.4	0.6646**		A	6.91		
		<i>qTBN-7-1</i>	7.02	<i>PZE-107049384/PZE-107057229</i>	65.7	61.7–66.0	0.7316**		A	11.07		
2015JH4	<i>qTBN-7-7</i>	7.06	<i>PZE-107121485/PZE-107130438</i>	141.9	135.9–146.9	1.2916**		A	18.5			
	<i>qTBN-9-2</i>	9.07/9.08	<i>PZE-109109278/SYN7122</i>	160.8	154.8–161.8	0.6314**		A	3.84			
	<i>qTBN-1-3</i>	1.11	<i>SYN22772/SYN11155</i>	222.7	216.7–224.5	-0.4909**		A	1.51	47.02	15.13	
	<i>qTBN-2-2</i>	2.03	<i>PZE-102037260/SYN35504</i>	29.6	28.6–32.6	0.7191**		A	10.95			
	<i>qTBN-7-1</i>	7.02	<i>PZE-107049384/PZE-107057229</i>	65.7	62.7–66.0	0.7034**		A	12.31			
		<i>qTBN-7-7</i>	7.06	<i>PZE-107121485/PZE-107130438</i>	138.9	132.9–145.9	1.0411**		A	17.69		
		<i>qTBN-9-2</i>	9.07/9.08	<i>PZE-109109278/SYN7122</i>	160.8	156.8–161.8	0.6013**		A	4.56		

<sup>a</sup>The specific genetic region included the peak position of QTL (<http://www.maizegdb.org/>).

<sup>b</sup>The confidence interval of QTL position.

<sup>c</sup>The additive effect of the QTL; positive values indicate that the alleles for increasing trait value are contributed by Ye478; negative values indicate that the allele for increasing trait value are contributed by another parent 08-641.

<sup>d</sup>The dominant effect of the QTL.

<sup>e</sup>A, D, PD, and OD represent additive, dominance, partial dominance, over-dominance effect, respectively.

<sup>f</sup>Percentage of phenotypic variance explained by a single QTL.

<sup>g</sup>Total percentage of phenotypic variance explained by all the mapped QTL for each trait.

<sup>h</sup>The *F*-statistic ( $P < 0.05$ ) value were conducted by QTL Network with 1000 random permutation.

\*, \*\*Significance at 0.05 and 0.01 levels, respectively.