



Figure S1. *TaCKX* GFM and *NAC2* expression patterns in 7 DAP spikes, seedling roots, and phenotypic traits in mother, pater, and their six F₂ progeny, from crosses of S6C x S3C (C3), S6C x S12B (C4*) and S6C x S5C (C5). * The data for the C4 cross have already been presented in Szala et al. [24], where S16C was a component of the reciprocal cross.

Table S1. Measurement data of phenotypic traits presented in Figure 1, 2 and S1, in which data were related to mother set as 1.00.

		Plant height [cm]		Spike no.		Semi-empty spikes		Grain no.		Grain yield [g]		Spike length [cm]		TGW		Root weight [mg]		CKX act. Spike 7DAP		CKX act. Root	
		Average for parents	OD for parents	Average for parents	OD for parents	Average for parents	OD for parents	Average for parents	OD for parents	Average for parents	OD for parents	Average for parents	OD for parents	Average for parents	OD for parents	Average for parents	OD for parents	Average for parents	OD for parents	Average for parents	OD for parents
C1	S12B ♀	75.0	5.0	7.3	0.6	0.018	0.016	248.3	41.0	11.8	1.0	10.0	0.2	47.9	4.3	40.7	18.3	0.575	0.052	1.062	0.592
	S6C ♂	71.0	3.6	5.7	1.2	0.000	0.000	173.0	9.2	8.8	0.8	9.6	0.6	50.5	2.2	48.7	16.9	1.057	0.214	1.123	0.440
	F ₂ 1	75.0		6.0		0.014		202.0		10.3		10.7		50.8		56.0		0.709		0.979	
	F ₂ 2	70.0		6.0		0.027		182.0		8.5		10.2		46.8		66.0		0.961		0.746	
	F ₂ 3	78.0		6.0		0.027		129.0		6.3		9.5		48.6		59.0		1.292		1.145	
	F ₂ 4	52.0		1.0		0.014		2.0		0.1		4.0		50.0		67.0		0.197		0.681	
	F ₂ 5	77.0		7.0		0.000		283.0		13.8		10.6		48.8		15.0		0.962		0.594	
	F ₂ 6	76.0		5.0		0.000		199.0		9.0		12.9		45.0		10.0		0.555		0.784	
C2	S12B ♀	75.0	5.0	7.3	0.6	0.018	0.016	248.3	41.0	11.8	1.0	10.0	0.2	47.9	4.3	40.7	18.3	0.575	0.052	1.062	0.592
	S5C ♂	72.3	2.5	5.0	1.0	0.005	0.008	165.0	52.6	6.7	1.1	9.5	1.0	42.7	9.1	74.7	25.0	1.109	0.203	0.891	0.084
	F ₂ 1	77.0		6.0		0.027		225.0		10.0		11.2		44.4		18.0		0.835		0.693	
	F ₂ 2	81.0		7.0		0.000		223.0		11.1		9.8		49.6		79.0		1.234		1.098	
	F ₂ 3	78.0		7.0		0.027		202.0		9.2		8.6		45.7		83.0		0.609			
	F ₂ 4	86.0		6.0		0.000		203.0		10.0		9.6		49.1		90.0		1.157		0.800	
	F ₂ 5	81.0		3.0		0.014		25.0		0.9		7.5		37.6		90.0		1.259		1.772	
	F ₂ 6	71.0		4.0		0.000		102.0		5.0		8.8		49.2		106.0		0.460		1.482	
C3	S6C ♀	71.0	3.6	5.7	1.2	0.000	0.000	173.0	9.2	8.8	0.8	9.6	0.6	50.5	2.2	48.7	16.9	1.057	0.214	1.123	0.440
	S3C ♂	77.0	2.6	6.3	1.5	0.014	0.014	185.7	39.9	9.5	2.0	7.3	0.3	51.1	0.1	36.3	2.5	1.013	0.221	0.416	0.006
	F ₂ 1	68.0		7.0		0.014		74.0		3.4		5.0		45.4		113.0		0.975		0.707	
	F ₂ 2	76.0		7.0		0.000		233.0		11.7		8.5		50.3		64.0		1.328		0.734	
	F ₂ 3	77.0		12.0		0.069		369.0		9.7		8.8		26.3		35.0		1.076		0.604	
	F ₂ 4	77.0		8.0		0.000		239.0		9.5		7.7		39.8		54.0		1.531		1.034	
	F ₂ 5	66.0		3.0		0.000		39.0		1.5		6.0		39.5		78.0		2.057		0.470	
	F ₂ 6	86.0		8.0		0.000		271.0		13.0		8.0		47.9		34.0		2.319		0.925	

C4	S6C ♀	71.0	3.6	5.7	1.2	0.000	0.000	173.0	9.2	8.8	0.8	9.6	0.6	50.5	2.2	48.7	16.9	1.057	0.214	1.123	0.440
	S12B ♂	75.0	5.0	7.3	0.6	0.018	0.016	248.3	41.0	11.8	1.0	10.0	0.2	47.9	4.3	40.7	18.3	0.575	0.052	1.062	0.592
	F ₂ 1	73.0		9.0		0.000		257.0		12.9		9.4		50.0		69.0		0.792		1.039	
	F ₂ 2	72.0		8.0		0.041		352.0		17.9		11.6		50.7		71.0		0.601		1.049	
	F ₂ 3	69.0		8.0		0.000		235.0		12.1		9.6		51.3		41.0		0.878		1.084	
	F ₂ 4	76.0		4.0		0.000		147.0		8.0		11.0		54.1		96.0		0.476		1.234	
	F ₂ 5	78.0		6.0		0.000		250.0		11.5		12.2		46.0		47.0		1.173		0.568	
	F ₂ 6	75.0		4.0		0.055		120.0		6.9		11.3		57.2		67.0		1.317		1.988	
C5	S6C ♀	71.0	3.6	5.7	1.2	0.000	0.000	173.0	9.2	8.8	0.8	9.6	0.6	50.5	2.2	48.7	16.9	1.057	0.214	1.123	0.440
	S5C ♂	72.3	2.5	5.0	1.0	0.005	0.008	165.0	52.6	6.7	1.1	9.5	1.0	42.7	9.1	74.7	25.0	1.109	0.203	0.891	0.084
	F ₂ 1	67.0		13.0		0.055		374.0		17.9		8.8		47.9		99.0		1.157		0.616	
	F ₂ 2	68.0		9.0		0.027		239.0		13.0		9.3		54.5		87.0		1.286		0.506	
	F ₂ 3	72.0		6.0		0.000		219.0		13.2		10.0		60.5		67.0		1.230		0.624	
	F ₂ 4	64.0		3.0		0.014		50.0		2.6		8.8		52.8		100.0		1.806		0.704	
	F ₂ 5	71.0		2.0		0.014		11.0		0.4		8.0		38.2		94.0		0.819		0.646	
	F ₂ 6	81.0		6.0		0.000		266.0		12.8		11.0		47.9		43.0		0.823		0.719	
C6	P9 ♀	40.0	1.0	4.7	2.1	1.667	1.528	104.3	72.7	2.2	1.0	7.8	1.0	24.5	12.5	92.7	12.1	1.009	0.180		
	S8 ♂	77.0	2.6	6.3	3.1	0.000	0.000	278.7	153.4	10.8	5.6	12.1	1.2	40.0	4.2	76.3	7.6	0.985	0.101		
	F ₂ 1	80.0		8.0		2.000		273.0		12.8		10.9		47.0		101.0		0.946			
	F ₂ 2	56.0		4.0		2.000		90.0		2.4		6.7		26.6		94.0		0.871			
	F ₂ 3	55.0		6.0		1.000		86.0		3.1		6.8		35.8		114.0		0.970			
	F ₂ 4	67.0		6.0		0.000		215.0		7.6		10.5		35.1		87.0		0.857			
	F ₂ 5	83.0		7.0		0.000		309.0		12.7		9.7		41.1		64.0		1.247			
	F ₂ 6	74.0		9.0		0.000		313.0		9.8		9.8		31.3		74.0		0.780			
C7	S8 ♀	77.0	2.6	6.3	3.1	0.000	0.000	278.7	153.4	10.8	5.6	12.1	1.2	40.0	4.2	76.3	7.6	0.985	0.101		
	P9 ♂	40.0	1.0	4.7	2.1	1.667	1.528	104.3	72.7	2.2	1.0	7.8	1.0	24.5	12.5	92.7	12.1	1.009	0.180		
	F ₂ 1	75.0		7.0		0.000		247.0		11.5		8.8		46.5		86.0		0.935			
	F ₂ 2	74.0		6.0		0.000		220.0		10.3		9.8		46.6		85.0		1.402			
	F ₂ 3	62.0		3.0		0.000		63.0		1.7		7.5		27.3		90.0		0.820			
	F ₂ 4	72.0		7.0		0.000		222.0		8.6		8.2		38.9		66.0		1.219			
	F ₂ 5	79.0		7.0		0.000		247.0		12.3		8.1		49.8		70.0		0.844			
	F ₂ 6	54.0		3.0				58.0		2.9		7.5		49.3		82.0		0.584			

Highlighted in blue – specific to mother and F₂; highlighted in green – specific to pater and F₂; highlighted in yellow – occurring in both groups.

C1 & C2 & C3 & C4 & C5			CKO2.1	CKO2.2.	CKX5	CKO9	CKX10	CKX11	NAC2-5A	CKX1	CKX3	CKX5	CKX8	CKX10	CKX11	NAC2-5A	Aktywność bezwzględna Korzeń	Aktywność bezwzględna Kłos 7DAP	Plant height	Spike number	Empty spike number	Semi-empty spike number	Grain number	Grain yield	Spike length	TGW
			Spike	2 Spike	Spike	Spike	Spike	Spike	Spike	Spike	Root	Root	Root	Root	Root	Root	Root	Root								
CKX1 Spike M1 + P1	M + F ₂ p + F ₂				0.73				0.63						-0.67			0.73						-0.61		
			0.24	0.13	0.39				-0.12				0.69		-0.43			0.58						-0.25		
CKX1 Spike M1 + P2	M + F ₂ p + F ₂		0.74	0.75					0.67			0.14		0.75		0.35		0.90	0.67							
									0.36	0.67				0.11		0.63		0.80	0.03							
CKX1 Spike M2 + P3	M + F ₂ p + F ₂								-0.06	0.68	0.78															
									0.67	0.68	0.52															
CKX1 Spike M2 + P4	M + F ₂ p + F ₂								0.16						-0.20			0.67			0.71					
									0.68						-0.60			0.87			0.55					
CKX1 Spike M2 + P2	M + F ₂ p + F ₂			0.51																						
				0.62																						
CKO2.1 Spike M1 + P1	M + F ₂ p + F ₂			0.05														0.62		0.50					0.65	
				0.60														0.33		0.67					0.33	
CKO2.1 Spike M1 + P2	M + F ₂ p + F ₂			-0.26				0.70		0.35						-0.62										
				0.81				0.57		0.71						0.29										
CKO2.1 Spike M2 + P3	M + F ₂ p + F ₂					-0.52				0.81					-0.67	0.29		-0.03								
						0.70				0.52					-0.44	0.83		0.69								
CKO2.1 Spike M2 + P4	M + F ₂ p + F ₂																									
CKO2.1 Spike M2 + P2	M + F ₂ p + F ₂			0.10		-0.65				0.74										0.65	0.73					
				0.75		-0.75				0.67										0.26	0.41					
CKO2.2.2 Spike M1 + P1	M + F ₂ p + F ₂																	0.37			0.65					-0.05
																		0.61			0.74				0.69	
CKO2.2.2 Spike M1 + P2	M + F ₂ p + F ₂				0.72	0.42	0.62							-0.60		-0.60		-0.61			0.61		0.81	0.13		
					0.01	0.68	0.22							-0.29		-0.50	0.60	-0.55			-0.02					
CKO2.2.2 Spike M2 + P3	M + F ₂ p + F ₂																				-0.10					
																					-0.62					
CKO2.2.2 Spike M2 + P4	M + F ₂ p + F ₂											0.60	0.64		0.87						0.73					
												0.63	0.56		0.74						0.14					
CKO2.2.2 Spike M2 + P2	M + F ₂ p + F ₂								0.69																	
									-0.28																	
CKX5 Spike M1 + P1	M + F ₂ p + F ₂				0.50				0.68		-0.61	-0.33	0.29	0.22		-0.64	-0.37					0.62	-0.69			
					0.76				0.80		-0.78	-0.61	0.66	0.63		0.01	-0.61					0.90	-0.32			
CKX5 Spike M1 + P2	M + F ₂ p + F ₂					0.43											-0.62					0.78				
						0.67											-0.26					0.31				
CKX5 Spike M2 + P3	M + F ₂ p + F ₂				-0.68	0.48												-0.68						-0.67		
					0.03	0.62												-0.67					0.02			
CKX5 Spike M2 + P4	M + F ₂ p + F ₂												-0.02													
													-0.60													
CKX5 Spike M2 + P2	M + F ₂ p + F ₂				0.84	0.78																				
					0.50	0.87																				
CKX9 Spike M1 + P1	M + F ₂ p + F ₂								0.38		-0.08											0.29				
									0.72		-0.66											0.66				
CKX9 Spike M1 + P2	M + F ₂ p + F ₂								0.68								-0.68		0.60	0.38						
									0.28								-0.43		0.55	0.66		0.65				
CKX9 Spike M2 + P3	M + F ₂ p + F ₂											-0.54	-0.35	0.70	-0.49	-0.49		-0.51								
												-0.61	-0.70	0.47	-0.85	-0.60		-0.61								
CKX9 Spike M2 + P4	M + F ₂ p + F ₂						0.60			-0.72												0.71			0.71	
							0.49			-0.21												0.50			0.42	
CKX9 Spike M2 + P2	M + F ₂ p + F ₂																									
CKX10 Spike M1 + P1	M + F ₂ p + F ₂								0.75	0.83				0.61		-0.18										0.73
									0.75	0.59				0.69		-0.69										0.13
CKX10 Spike M1 + P2	M + F ₂ p + F ₂												-0.33	-0.93	-0.29	-0.93	-0.69					0.64				
													-0.62	-0.74	-0.62	-0.90	-0.36					0.31				
CKX10 Spike M2 + P3	M + F ₂ p + F ₂								0.75		-0.69		0.91		0.88		-0.76								-0.78	
							0.57				-0.69		-0.13		0.15		0.04								-0.28	
CKX10 Spike M2 + P4	M + F ₂ p + F ₂																									
CKX10 Spike M2 + P2	M + F ₂ p + F ₂															-0.60	-0.63									
																-0.02	-0.27									
CKX11 Spike M1 + P1	M + F ₂ p + F ₂							0.79	-0.26				0.88		-0.71						-0.71		0.02	-0.65		
								0.28	-0.69				0.86		0.07						-0.02		0.76	-0.15		
CKX11 Spike M1 + P2	M + F ₂ p + F ₂																	0.66	0.79							
																		0.24	-0.08							
CKX11 Spike M2 + P3	M + F ₂ p + F ₂										-0.67		0.62	0.61	0.70						0.67				-0.63	
											-0.64		-0.37	-0.41	-0.14						-0.13				0.01	
CKX11 Spike M2 + P4	M + F ₂ p + F ₂										-0.83	-0.69	0.73	0.62		-0.29		0.04	0.83						0.64	
											-0.51	-0.33	0.62	0.35		0.67		0.60	0.25						0.49	
CKX11 Spike M2 + P2	M + F ₂ p + F ₂										-0.62				0.51		-0.74									
											-0.02				0.75		0.22									
NAC2-5A Spike M1 + P1	M + F ₂ p + F ₂										-0.32		0.66			-0.65							-0.66	-0.71	0.70	
											-0.78		0.61		-0.88								-0.39	-0.55	0.50	
NAC2-5A Spike M1 + P2	M + F ₂ p + F ₂																0.78				0.73		-0.64	-0.77		
																	0.36				0.21		-0.46	-0.35		
NAC2-5A Spike M2 + P3	M + F ₂ p + F ₂										-0.48										-0.31		-0.49	-0.62		
											-0.90										-0.75		-0.84	-0.62		
NAC2-5A Spike M2 + P4	M + F ₂ p + F ₂															-0.68										
																-0.63										
NAC2-5A Spike M2 + P2	M + F ₂ p + F ₂													-0.35		-0.71										
													-0.66			0.46										

Table S3. Correlation coefficients between the expression of *TaCKX* GFM and *NAC2* in spikes or spikes per roots, as well as yield-related traits in the groups of M + F₂ and P + F₂ of reciprocal crosses of awned x awnless (C6) and awnless x awned parents (C7).

7K (C6 awned x awnless)		CKX2.1 Spike	CKX2.2.2 Spike	CKX5 Spike	CKX9 Spike	CKX10 Spike	CKX11 Spike	NAC2-5A Spike	CKX1 Root	CKX3 Root	CKX5 Root	CKX8 Root	CKX10 Root	CKX11 Root	NAC2-5A Root	Plant height	Spike number	Empty spike number	Semi-empty spike	Grain number	Grain yield	Spike length	TGW	Root weight	
CKX1 Spike	C6 (M + F ₂)	0.78	0.82	0.71	0.67	0.69	0.86	0.67			0.79	-0.71	-0.82		0.74					-0.52	-0.42	0.11		-0.70	
	C6 (P + F ₂)	0.72	0.83	0.71	0.69	0.76	0.86	0.69			0.00	-0.18	-0.79		0.02					0.60	0.60	0.65		-0.60	
CKX2.1 Spike	C6 (M + F ₂)		0.88	0.81	0.72	0.81		0.81	-0.67										-0.27				-0.62	-0.90	
	C6 (P + F ₂)		0.80	0.76	0.77	0.90		0.81	-0.13										-0.79				0.24	-0.66	
CKX2.2.2 Spike	C6 (M + F ₂)			0.64	0.76	0.83	0.62	0.71			0.61	-0.68							-0.39					-0.97	
	C6 (P + F ₂)			0.75	0.74	0.83	0.62	0.69			-0.25	-0.11							-0.78					-0.88	
CKX5 Spike	C6 (M + F ₂)				0.84	0.75	0.99	0.79	-0.93		0.98	-0.87	-0.84	-0.82	0.90	-0.83	-0.80			-0.70	-0.68		-0.84	-0.69	
	C6 (P + F ₂)				0.86	0.82	0.64	0.96	0.11	-0.61	0.21	-0.43	-0.36	-0.57	-0.57	0.07	-0.35			0.12	0.00		0.17	-0.31	
CKX9 Spike	C6 (M + F ₂)					0.99	0.90	0.92	-0.76		0.92	-0.84	-0.70		0.73	-0.88	-0.82			-0.72	-0.70	-0.41	-0.89	-0.73	
	C6 (P + F ₂)					0.60	0.95	0.92	0.39		-0.08	-0.27	-0.59		-0.31	0.37	-0.01			0.33	0.33	0.72	0.26	-0.36	
CKX10 Spike	C6 (M + F ₂)						0.84	0.86	-0.71		0.84	-0.82	-0.61		0.62	-0.82	-0.79		-0.46	-0.67	-0.64		-0.86	-0.72	
	C6 (P + F ₂)						0.42	0.84	0.28		-0.14	-0.15	-0.54		-0.25	0.35	0.54		-0.87	0.64	0.58		0.06	-0.24	
CKX11 Spike	C6 (M + F ₂)							0.86	-0.79		0.97	-0.93	-0.76		0.88	-0.86	-0.86			-0.73	-0.69	0.06	-0.89	-0.77	
	C6 (P + F ₂)							0.77	0.15		-0.19	-0.12	-0.49		-0.24	0.35	0.15			0.42	0.34	0.73	0.09	-0.35	
NAC2-5A Spike	C6 (M + F ₂)								-0.80		0.96	-0.92	-0.75		0.90	-0.88	-0.86		-0.31	-0.72	-0.69	-0.25	-0.88	-0.80	
	C6 (P + F ₂)								0.50		-0.07	-0.15	-0.58		-0.25	0.43	0.24		-0.70	0.50	0.44	0.67	0.20	-0.45	
8K (C7 awnless x awned)		CKX2.1 Spike	CKX2.2.2 Spike	CKX5 Spike	CKX9 Spike	CKX10 Spike	CKX11 Spike	NAC2-5A Spike	CKX1 Root	CKX3 Root	CKX5 Root	CKX8 Root	CKX10 Root	CKX11 Root	NAC2-5A Root	Plant height	Spike number	Empty spike number	Semi-empty spike number	Grain number	Grain yield	Spike length	TGW	Root weight	
CKX1 Spike	C7 (M + F ₂)	0.79		0.75	0.87	0.71	0.77	0.93	0.27	0.12		0.67				0.41				0.17	0.43		0.92	-0.45	-0.19
	C7 (P + F ₂)	0.81		0.75	0.85	0.64	0.77	0.92	-0.73	-0.67		-0.45				-0.67			0.79	-0.60		-0.14	-0.78	-0.64	
CKX2.1 Spike	C7 (M + F ₂)		0.81	0.95	0.99	0.68	0.90	0.97	0.83	0.71	0.93	0.79	-0.02	-0.55	0.22	0.50	0.20			0.17	0.27	0.35	0.85	-0.17	
	C7 (P + F ₂)		0.83	0.91	0.90	0.80	0.94	0.97	-0.43	-0.30	0.98	-0.87	-0.77	-0.80	0.98	-0.92	-0.67		0.79	-0.78	-0.73	-0.49	-0.89		
CKX2.2.2 Spike	C7 (M + F ₂)			0.86		0.69	0.60		0.38			0.31		-0.86		0.30	0.11			0.17	0.16	0.02	-0.28	-0.45	
	C7 (P + F ₂)			0.75		0.69	0.60		-0.62			-0.81		-0.88		-0.85	-0.62		0.79	-0.70	-0.72	-0.62	-0.78		
CKX5 Spike	C7 (M + F ₂)				0.92	0.53	0.77	0.90	0.95	0.92	0.99	0.79	-0.26	-0.45	0.56	0.66	0.17		bd	0.32	0.40	0.79	0.04	-0.38	
	C7 (P + F ₂)				0.83	0.75	0.99	0.79	-0.63	-0.48	1.00	-0.90	-0.81	-0.82	0.98	-0.86	-0.80		0.87	-0.89	-0.66	-0.51	-0.85	-0.79	
CKX9 Spike	C7 (M + F ₂)					0.60	0.95	0.93	0.75	0.82	0.88	0.80	0.01	-0.55	0.13	0.45	0.09		bd	0.33	0.35	0.93	-0.25	-0.14	
	C7 (P + F ₂)					0.99	0.91	0.93	-0.62	-0.24	0.94	-0.85	-0.60	-0.71	0.81	-0.91	-0.85		0.82	-0.78	-0.70	-0.59	-0.90	-0.82	
CKX10 Spike	C7 (M + F ₂)						0.42	0.84	0.66	0.80	0.82	0.78		-0.51	0.38	0.47	0.40		bd	0.52	0.65	0.60	-0.14	-0.11	
	C7 (P + F ₂)						0.84	0.86	-0.57	-0.03	0.87	-0.79		-0.62	0.69	-0.86	-0.74		0.85	-0.71	-0.65	-0.60	-0.85	-0.79	
CKX11 Spike	C7 (M + F ₂)							0.78	0.55	0.70	0.73	0.77	0.10	-0.52	0.09	0.37	0.18		bd	0.31	0.34	0.91	-0.29	-0.03	
	C7 (P + F ₂)							0.87	-0.63	-0.47	1.00	-0.89	-0.73	-0.79	0.95	-0.90	-0.78		0.82	-0.83	-0.71	-0.57	-0.90	-0.81	
NAC2-5A Spike	C7 (M + F ₂)								0.87	0.87	0.95	0.79	-0.06	-0.54	0.15	0.48	0.18		bd	0.38	0.44	0.86	-0.21	-0.17	
	C7 (P + F ₂)								-0.62	-0.51	1.00	-0.89	-0.74	-0.79	0.96	-0.92	-0.75		0.82	-0.68	-0.70	-0.47	-0.88	-0.84	

Highlighted in blue – specific to mother and F₂; highlighted in green – specific to pater and F₂; highlighted in yellow – occurring in both groups. Bold – significant at $p \geq 0.01$.