Table S3. Complete list of stable QTLs detected for four nutritional quality traits

Traits[a]	QTL	Chromosome	Position (Mb)	Number of significant SNPs	PVE (%)	References
ANs	*ANs.pkuias.1A.1*	1A	354.09-355.45	2	38.33-39.34	Zhou et al., 2017
	ANs.pkuias.1A.2	1A	389.28-391.14	4	30.81-43.97	
	ANs.pkuias.1B	1B	441.40-441.40	3	30.73-30.91	
	ANs.pkuias.2B	2B	102.09-102.35	2	2.58-39.10	
	ANs.pkuias.2D	2D	34.49-34.49	5	41.42-43.40	
	ANs.pkuias.3A	3A	78.57-79.83	2	23.55-35.11	Rasheed et al., 2016
	ANs.pkuias.3B.1	3B	423.15-423.15	2	29.42-32.38	Zhou et al., 2017
	ANs.pkuias.3B.2	3B	445.27-445.27	2	18.08-24.40	Bi et al., 2014
	ANs.pkuias.4B.1	4B	86.31-86.31	2	39.50-39.50	
	ANs.pkuias.4B.2	4B	548.88-550.69	5	11.39-31.73	
	ANs.pkuias.5B.1	5B	288.26-288.26	2	38.96-39.77	
	ANs.pkuias.5B.2	5B	387.91-387.91	2	32.38-33.38	
	ANs.pkuias.5B.3	5B	435.19-437.4	9	17.12-43.74	
	ANs.pkuias.5B.4	5B	673.66-675.48	2	24.89-25.06	
	ANs.pkuias.5D.1	5D	350.63-350.63	2	26.58-31.68	
	ANs.pkuias.5D.2	5D	496.94-496.94	6	16.40-22.63	
	ANs.pkuias.6A.1	6A	59.62-61.06	11	20.11-46.41	Zhou et al., 2017
	ANs.pkuias.6A.2	6A	229.76-229.76	3	29.72-31.90	
	ANs.pkuias.6B.1	6B	485.51-485.51	7	30.39-39.95	
	ANs.pkuias.6B.2	6B	512.53-515.74	6	0.23-32.89	
	ANs.pkuias.7A	7A	619.24-620.06	4	6.34-32.77	Zhou et al., 2017
	ANs.pkuias.7B.1	7B	242.85-242.85	2	37.32-37.32	
	ANs.pkuias.7B.2	7B	591.77-593.04	2	33.06-38.13	
	ANs.pkuias.7B.3	7B	733.83-735.74	35	26.28-43.21	
	ANs.pkuias.7B.4	7B	750.30-750.30	3	11.31-19.30	
	ANs.pkuias.7D	7D	517.57-518.31	2	44.81-44.86	Jiang et al., 2018
CF	*CF.pkuias.1A*	1A	315.74-315.74	3	35.14-38.90	
	CF.pkuias.1D	1D	315.04-315.04	5	33.04-39.89	
	CF.pkuias.2B.1	2B	34.61-34.61	4	36.38-37.33	
	CF.pkuias.2B.2	2B	257.41-260.31	9	0.39-35.91	
	CF.pkuias.2B.3	2B	399.60-403.79	7	2.45-42.70	
	CF.pkuias.2B.4	2B	405.15-428.79	75	0.85-40.92	
	CF.pkuias.2B.5	2B	432.09-453.65	65	1.94-46.32	
	CF.pkuias.2B.6	2B	460.12-476.90	23	2.79-50.68	
	CF.pkuias.2B.7	2B	633.06-635.28	4	40.91-44.04	
	CF.pkuias.3B.1	3B	45.54-48.35	5	25.00-32.63	

	CF.pkuias.3B.2	3B	676.60-676.60	3	35.03-46.28	
	CF.pkuias.4A	4A	614.32-614.32	2	35.13-41.94	
	CF.pkuias.5A.1	5A	489.98-494.14	6	37.32-50.70	
	CF.pkuias.5A.2	5A	499.13-501.46	7	0.52-36.53	
	CF.pkuias.5B.1	5B	256.65-257.85	3	21.17-34.68	
	CF.pkuias.5B.2	5B	288.75-288.92	5	39.04-42.97	
	CF.pkuias.5B.3	5B	384.81-384.81	2	43.15-50.07	
	CF.pkuias.5B.4	5B	605.07-608.03	3	22.64-41.25	
	CF.pkuias.5B.5	5B	723.18-723.18	2	51.21-51.21	
	CF.pkuias.5D	5D	30.02-30.02	2	27.09-30.22	
	CF.pkuias.6A	6A	571.23-573.57	2	28.22-48.05	
	CF.pkuias.6B.1	6B	42.89-42.89	6	32.17-45.73	
	CF.pkuias.6B.2	6B	219.26-219.26	3	28.43-29.73	
	CF.pkuias.6D	6D	434.75-434.75	2	35.57-39.72	
	CF.pkuias.7B.1	7B	440.85-442.90	4	4.86-50.31	
	CF.pkuias.7B.2	7B	572.70-582.17	26	9.63-38.57	
FAA	*FAA.pkuias.1A*	1A	558.43-562.63	9	4.40-49.01	Peng et al., 2018
	FAA.pkuias.1B	1B	650.10-650.55	6	27.38-36.77	Gao et al., 2016
	FAA.pkuias.2A	2A	699.77-702.42	4	25.28-38.30	
	FAA.pkuias.2B	2B	792.65-793.03	3	29.11-37.25	Lavoignat et al., 2024
	FAA.pkuias.3B	3B	802.51-802.74	5	29.68-38.20	
	FAA.pkuias.4A.1	4A	101.34-105.86	6	4.60-35.58	
	FAA.pkuias.4A.2	4A	111.18-118.86	8	0.96-34.88	
	FAA.pkuias.4B	4B	690.70-692.48	2	32.99-44.69	
	FAA.pkuias.5A	5A	480.09-480.11	2	31.79-36.93	
	FAA.pkuias.5B.1	5B	417.76-417.76	3	28.29-30.23	
	FAA.pkuias.5B.2	5B	485.63-485.63	3	35.22-43.71	
	FAA.pkuias.5D.1	5D	152.39-152.39	2	34.41-34.48	
	FAA.pkuias.5D.2	5D	332.93-332.93	2	35.82-37.05	
	FAA.pkuias.6B.1	6B	65.22-68.99	3	29.69-34.02	
	FAA.pkuias.6B.2	6B	164.12-164.12	3	32.84-32.84	
	FAA.pkuias.6B.3	6B	550.50-550.73	3	32.14-38.75	
	FAA.pkuias.7A	7A	6.76-10.69	2	24.40-37.28	
	FAA.pkuias.7B	7B	666.12-671.64	9	6.36-37.24	
	FAA.pkuias.7D	7D	595.27-597.09	4	3.90-33.92	
TN	*TN.pkuias.1A.1*	1A	4.34-4.34	2	15.04-15.84	Li et al., 2023
	TN.pkuias.1A.2	1A	555.83-561.05	6	3.52-44.82	
	TN.pkuias.1B.1	1B	353.06-353.06	2	44.86-46.61	

TN.pkuias.1B.2	1B	555.35-559.73	3	34.61-37.55	
TN.pkuias.1B.3	1B	606.97-608.40	4	15.59-29.10	
TN.pkuias.1B.4	1B	619.60-623.91	2	20.26-26.28	
TN.pkuias.1B.5	1B	633.22-634.48	2	29.31-43.31	
TN.pkuias.1B.6	1B	692.90-693.72	2	6.96-12.31	
TN.pkuias.1D.1	1D	148.56-150.10	3	7.77-26.66	
TN.pkuias.1D.2	1D	492.87-492.87	2	18.07-23.88	
TN.pkuias.2A.1	2A	0.44-0.81	2	16.05-25.74	
TN.pkuias.2A.2	2A	140.77-140.77	2	14.60-14.60	
TN.pkuias.2A.3	2A	295.25-297.69	2	20.81-33.19	
TN.pkuias.2A.4	2A	380.80-384.83	3	3.08-32.50	
TN.pkuias.2B.1	2B	270.56-274.21	8	16.40-36.11	
TN.pkuias.2B.2	2B	289.99-289.99	2	24.17-28.64	
TN.pkuias.2B.3	2B	299.09-306.19	3	18.65-33.72	
TN.pkuias.2B.4	2B	319.26-320.78	2	18.46-23.82	
TN.pkuias.2B.5	2B	373.68-374.21	4	21.46-39.07	
TN.pkuias.2B.6	2B	388.08-388.45	4	19.97-46.94	
TN.pkuias.2B.7	2B	483.58-483.58	2	10.96-11.28	
TN.pkuias.2B.8	2B	563.12-566.56	3	26.95-27.86	
TN.pkuias.2B.9	2B	580.55-585.25	6	8.91-33.88	
TN.pkuias.2B.10	2B	682.24-690.20	48	19.22-53.52	
TN.pkuias.2B.11	2B	752.47-755.44	5	18.18-37.43	Li et al., 2023
TN.pkuias.2D.1	2D	180.96-181.63	4	28.81-42.55	
TN.pkuias.2D.2	2D	491.31-491.31	3	17.38-23.03	
TN.pkuias.2D.3	2D	631.01-632.64	5	9.02-37.76	
TN.pkuias.3A.1	3A	609.45-609.45	3	43.83-48.90	
TN.pkuias.3A.2	3A	722.15-722.76	2	23.06-32.06	
TN.pkuias.3B.1	3B	21.92-23.47	16	16.26-31.83	
TN.pkuias.3B.2	3B	27.32-28.22	3	20.41-23.57	
TN.pkuias.3B.3	3B	39.86-39.86	2	24.58-32.72	
TN.pkuias.3B.4	3B	66.58-72.88	15	18.17-38.43	Li et al., 2023
TN.pkuias.3B.5	3B	106.90-108.12	2	21.28-43.50	
TN.pkuias.3B.6	3B	185.16-186.50	4	24.92-43.38	
TN.pkuias.3B.7	3B	521.98-522.46	6	0.46-46.58	
TN.pkuias.3B.8	3B	598.94-598.94	2	18.77-24.23	
TN.pkuias.4A.1	4A	39.32-44.57	22	0.23-50.39	
TN.pkuias.4A.2	4A	69.69-73.62	3	24.06-45.19	
TN.pkuias.4A.3	4A	194.21-201.30	6	14.36-41.54	

TN.pkuias.4A.4	4A	246.2-249.52	4	38.32-49.19	
TN.pkuias.4A.5	4A	277.22-283.26	5	16.30-46.61	
TN.pkuias.4A.6	4A	505.49-505.49	2	15.83-23.98	
TN.pkuias.4A.7	4A	571.31-599.00	31	0.12-48.83	Li et al., 2023
TN.pkuias.4A.8	4A	718.67-718.67	2	27.22-27.39	Guo et al., 2023; Li et al., 2023
TN.pkuias.4A.9	4A	728.51-728.51	2	16.56-16.56	
TN.pkuias.4B.1	4B	1.36-1.36	2	34.85-35.99	
TN.pkuias.4B.2	4B	9.00-11.04	2	13.78-14.16	
TN.pkuias.4B.3	4B	83.53-88.72	9	6.44-22.68	
TN.pkuias.4B.4	4B	167.93-173.22	5	15.69-21.90	
TN.pkuias.4B.5	4B	179.74-183.07	3	11.25-15.04	
TN.pkuias.4B.6	4B	198.00-219.00	9	10.82-35.81	
TN.pkuias.4B.7	4B	252.60-255.90	3	11.86-15.63	
TN.pkuias.4B.8	4B	303.56-306.22	6	16.01-22.09	
TN.pkuias.4B.9	4B	342.61-345.21	7	17.06-43.97	
TN.pkuias.4B.10	4B	410.13-410.13	4	9.68-10.81	
TN.pkuias.4B.11	4B	418.52-419.29	3	16.46-29.36	
TN.pkuias.4B.12	4B	444.11-464.93	39	4.46-39.89	Li et al., 2023
TN.pkuias.4B.13	4B	468.16-484.27	30	5.53-38.65	
TN.pkuias.4B.14	4B	489.59-494.90	12	29.18-48.88	
TN.pkuias.4B.15	4B	497.03-509.82	18	8.13-42.35	
TN.pkuias.4B.16	4B	523.72-553.89	100	0.17-54.60	
TN.pkuias.4B.17	4B	565.07-578.45	13	30.76-43.30	Jadon et al., 2023
TN.pkuias.4B.18	4B	599.02-610.87	31	29.14-47.18	Li et al., 2023; Jadon et al., 2023
TN.pkuias.4B.19	4B	636.11-641.74	10	0.34-55.66	Jadon et al., 2023
TN.pkuias.4D	4D	525.29-525.29	3	26.05-26.15	
TN.pkuias.5A.1	5A	218.79-220.62	2	22.41-37.38	
TN.pkuias.5A.2	5A	308.65-311.52	3	4.80-22.30	
TN.pkuias.5A.3	5A	563.04-569.50	5	19.58-35.91	Li et al., 2023
TN.pkuias.5B.1	5B	79.23-79.23	2	16.09-18.43	
TN.pkuias.5B.2	5B	110.69-113.03	3	12.88-22.18	
TN.pkuias.5B.3	5B	328.90-329.87	2	27.51-51.95	
TN.pkuias.5B.4	5B	376.25-376.25	4	33.66-34.97	
TN.pkuias.5B.5	5B	431.43-432.42	2	15.96-39.44	Li et al., 2023
TN.pkuias.5B.6	5B	502.08-502.08	2	33.43-33.43	Li et al., 2023
TN.pkuias.5B.7	5B	563.51-565.60	4	26.60-42.03	
TN.pkuias.5B.8	5B	583.74-585.34	2	20.77-50.98	
TN.pkuias.5B.9	5B	616.62-616.85	2	18.40-20.87	

TN.pkuias.5B.10	5B	654.75-662.27	11	0.68-26.83	
TN.pkuias.5B.11	5B	701.47-703.53	4	0.51-34.86	Li et al., 2023
TN.pkuias.5B.12	5B	715.03-718.49	2	27.50-33.64	Li et al., 2023
TN.pkuias.5D	5D	388.99-388.99	7	24.57-25.02	Li et al., 2023
TN.pkuias.6A.1	6A	225.46-225.46	3	14.33-19.77	
TN.pkuias.6A.2	6A	569.50-570.86	2	16.47-26.06	
TN.pkuias.6B.1	6B	221.69-223.54	3	7.25-35.78	
TN.pkuias.6B.2	6B	476.25-476.25	2	26.26-26.29	
TN.pkuias.6B.3	6B	515.36-515.36	2	32.02-32.02	
TN.pkuias.6B.4	6B	731.43-737.56	303	30.95-53.18	
TN.pkuias.6B.5	6B	744.96-744.96	2	20.16-22.94	
TN.pkuias.6D.1	6D	29.00-29.00	4	16.03-16.83	
TN.pkuias.6D.2	6D	422.22-422.22	2	28.30-29.14	
TN.pkuias.6D.3	6D	490.18-494.86	5	5.43-26.09	
TN.pkuias.7A.1	7A	124.33-132.19	33	16.35-28.46	Li et al., 2023
TN.pkuias.7A.2	7A	435.32-436.64	2	21.65-25.07	
TN.pkuias.7A.3	7A	728.11-730.00	2	32.83-33.65	
TN.pkuias.7B.1	7B	215.70-215.70	3	29.84-32.23	
TN.pkuias.7B.2	7B	372.98-372.98	2	37.18-37.27	
TN.pkuias.7B.3	7B	457.03-459.28	2	17.28-19.48	
TN.pkuias.7B.4	7B	497.34-497.77	3	24.60-39.90	
TN.pkuias.7B.5	7B	683.14-690.00	3	19.84-25.90	
TN.pkuias.7D.1	7D	376.50-376.50	3	32.90-36.14	Li et al., 2023
TN.pkuias.7D.2	7D	627.17-627.17	3	28.81-38.51	
TN.pkuias.7D.3	7D	634.22-634.25	2	27.46-30.19	
TN.pkuias.7D.4	7D	651.73-651.73	3	33.40-39.17	

[a] TN, total nitrogen; CF, crude fat; ANs, anthocyanins; FAA, free amino acids