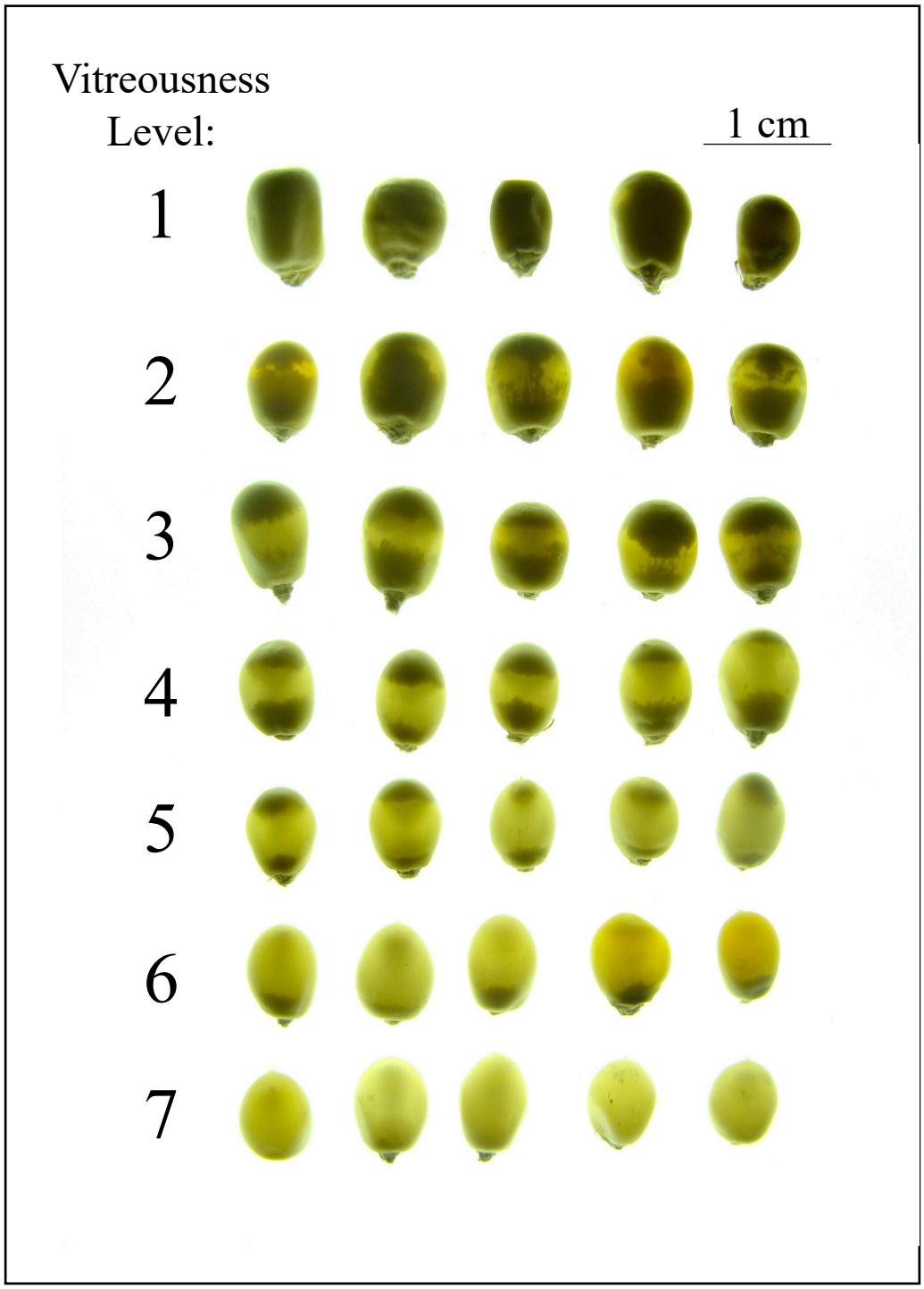
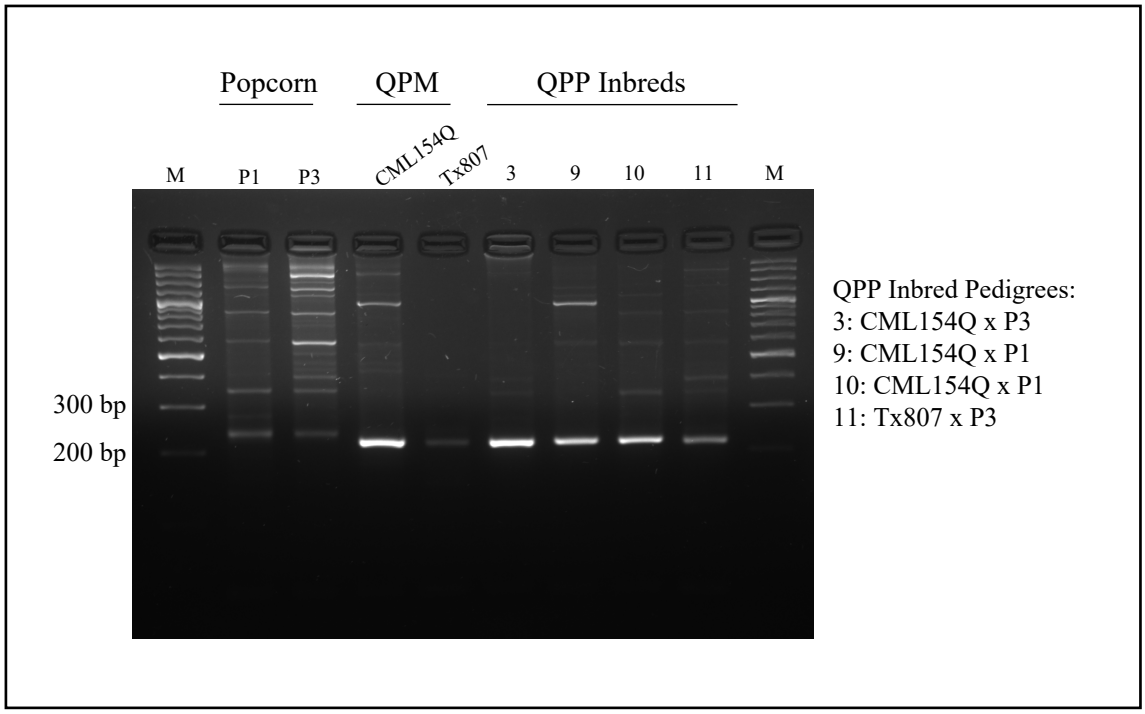
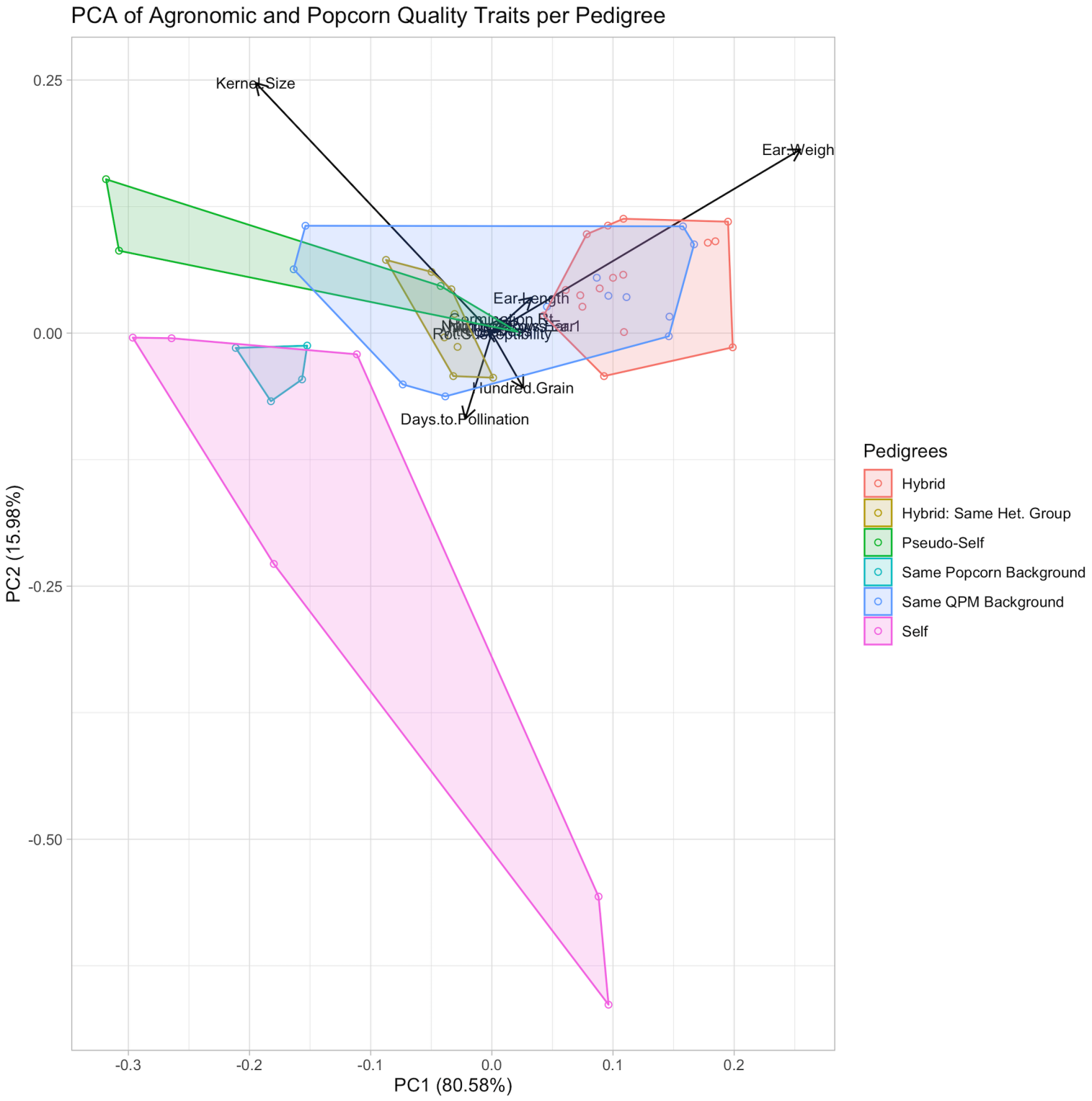
Supplementary Material



Supplementary Figure 1 | Popcorn kernel endosperm vitreousness scale. Ten grams of kernels were randomly selected from each row of the 2019 field and scored on a continuous scale of 1-7, with a rank of '1' being nearly complete opacity and '7' as completely vitreous.

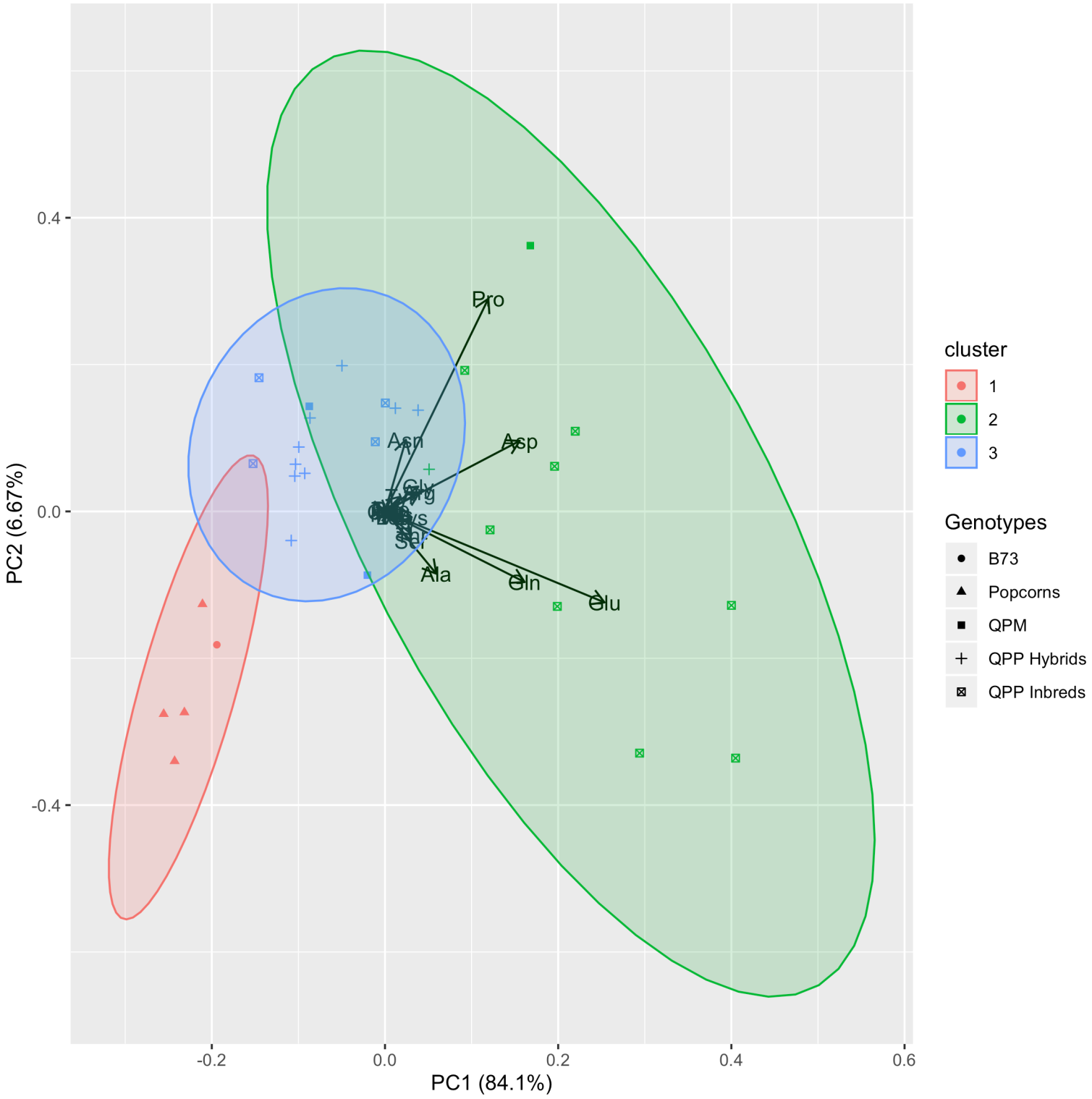


Supplementary Figure 2 | DNA-based marker aided verification of *o2o2* genotype in parental inbreds. All QPP inbred parents were genotyped with *opaque-2* in-gene marker umc1066 and/or flanking marker bnlg1200. As shown, popcorn parents encode a differentiated, wild-type *opaque2* allele while QPM parents have a lower band. All QPP inbreds shown are crosses between Popcorn Parent 1, Popcorn Parent 3, and CML154Q and Tx807. All inbreds displayed the alike lower band to QPM parents.

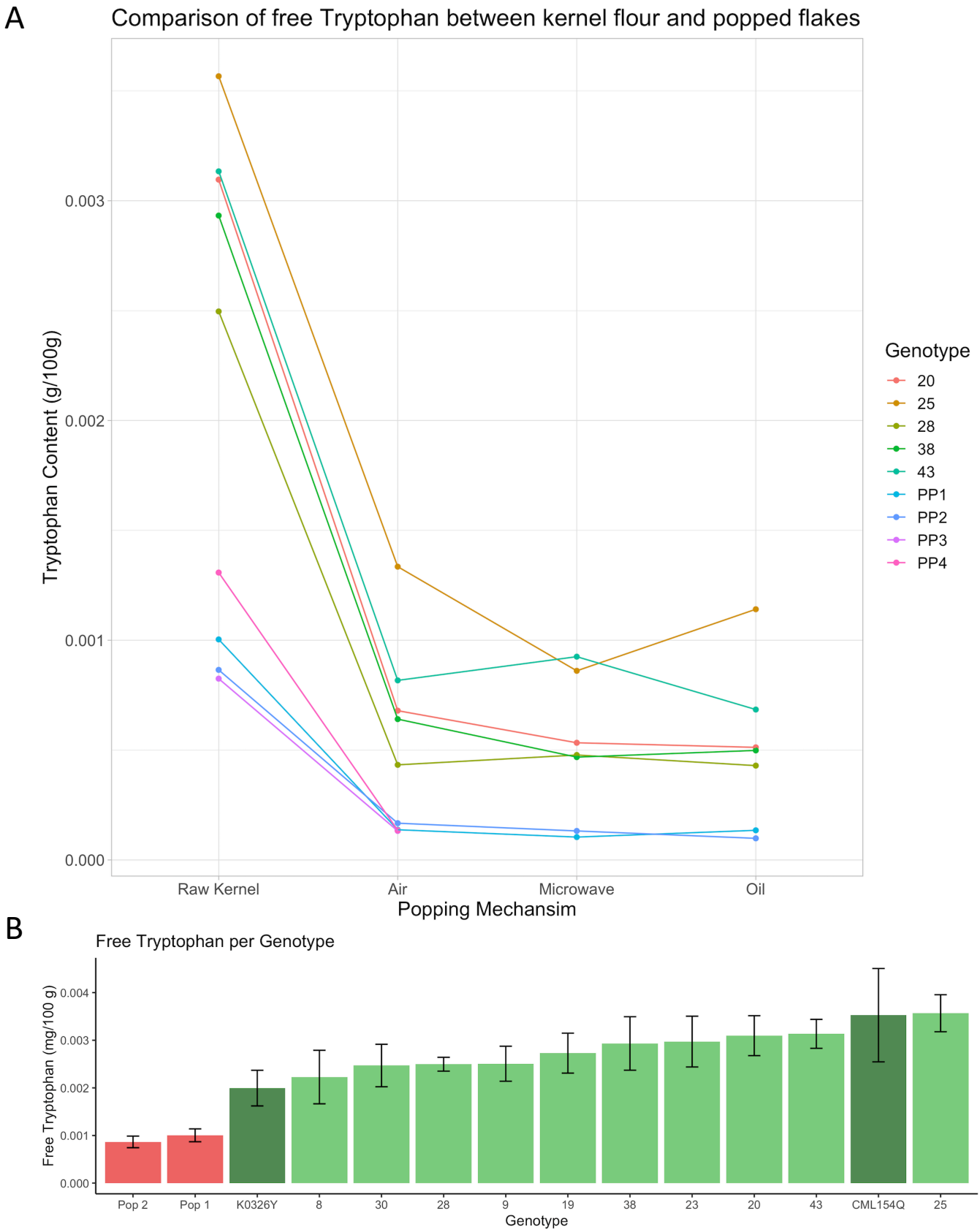


Supplementary Figure 3 | Principle Component Analysis of QPP Hybrids, Inbreds, QPM, and Popcorn Parents Grown in 2019 fields. Principle Component scores (PC1 and PC2) from each variable are described as text in plot. Six clusters of pedigree categories (Self, Pseudo-self, Same Popcorn Background, Same QPM Background, Hybrid: Same Het. Group, and Hybrid) were observed.

Principle Component Analysis of Free Amino Acid Profiles from Raw Kernel Flour in Multiple Germplasms



Supplementary Figure 4 | Principle Component Analysis of Free Amino Acids from raw Kernel Flour in Multiple Germplasms. All amino acids were available for quantification in free form. Three clusters arose from the data; one of popcorn parents (red), one of QPP hybrids (blue), and one of QPP inbreds (green). Inbreds were characterized with higher proline, aspartate, glutamate, and glutamine levels. QPP hybrids overlapped with both clusters though most overlay occurred between QPP Inbreds and Hybrids. QPM inbreds were present in both QPP inbred and hybrid clusters.



Supplementary Figure 5 | Free Tryptophan Values and Effect of Popping Methods. **(A)** Alike to protein-bound and free lysine, free tryptophan values from raw kernel flour decreased at a similar rate when popped by multiple methods and correlation coefficients were high (range of 0.882 – 0.992). **(B)** All QPP hybrids (light green) held larger raw kernel flour free-tryptophan values than popcorn parents (red) and potentially QPM parents (dark green). At minimum, QPP hybrids were insignificantly different in free tryptophan content than QPM parents.

Genotype	Ala	Arg	Asx	Glx	Gly	His	Ile	Leu	Lys	Met	Phe	Pro	Ser	Thr	Tyr	Val
Popcorn Parent 1	1.101±0.052	0.358±0.023	0.793±0.056	2.751±0.075	0.952±0.08	0.452±0.014	0.647±0.044	2.084±0.123	0.372±0.026	0.257±0.021	0.71±0.014	1.267±0.058	0.692±0.03	0.589±0.049	0.461±0.034	0.557±0.02
Popcorn Parent 2	0.963±0.126	0.362±0.025	0.664±0.047	2.449±0.201	0.886±0.115	0.394±0.015	0.58±0.059	1.852±0.177	0.326±0.018	0.194±0.02	0.652±0.051	1.1±0.069	0.638±0.061	0.5±0.042	0.379±0.035	0.498±0.032
Popcorn Parent 3	0.996±0.012	0.354±0.002	0.685±0.006	2.446±0.048	0.804±0.009	0.385±0.015	0.563±0.004	1.848±0.042	0.415±0.015	0.196±0.004	0.667±0.027	1.216±0.003	0.658±0	0.591±0.034	0.413±0.037	0.5±0
Popcorn Parent 4	1.385±0.035	0.402±0.017	0.861±0.002	3.145±0.189	1.222±0.035	0.458±0.017	0.802±0.02	2.617±0.171	0.363±0.049	0.236±0.009	0.817±0.05	1.321±0.077	0.832±0.04	0.628±0.038	0.574±0.008	0.662±0.012
B73	0.92±0.041	0.46±0.02	0.735±0.041	2.369±0.108	0.924±0.07	0.439±0.017	0.554±0.041	1.65±0.096	0.457±0.033	0.209±0.007	0.636±0.025	1.078±0.054	0.64±0.023	0.523±0.031	0.373±0.006	0.538±0.028
CML154Q	0.754±0.058	0.57±0.033	1.098±0.133	2.233±0.161	0.93±0.029	0.541±0.026	0.509±0.051	1.187±0.173	0.629±0.022	0.153±0.007	0.557±0.037	1.183±0.102	0.586±0.04	0.548±0.04	0.311±0.034	0.6±0.007
K0326Y	0.751±0.107	0.585±0.057	0.955±0.185	2.16±0.213	0.866±0.125	0.576±0.024	0.487±0.047	1.257±0.141	0.589±0.066	0.166±0.013	0.545±0.05	1.168±0.088	0.611±0.069	0.543±0.062	0.307±0.023	0.603±0.052
Tx807	0.874±0.109	0.632±0.046	1.496±0.026	2.447±0.097	0.99±0.032	0.571±0.019	0.609±0.059	1.56±0.231	0.667±0.002	0.15±0.009	0.663±0.046	1.132±0.08	0.689±0.053	0.604±0.049	0.351±0.016	0.63±0.023
QPP Inbred 1	0.674±0.05	0.401±0.045	0.967±0.026	2.247±0.043	0.876±0.104	0.527±0.031	0.448±0.034	1.166±0.115	0.503±0.018	0.122±0.011	0.503±0.033	1.12±0.032	0.518±0.024	0.483±0.009	0.302±0.034	0.53±0.042
QPP Inbred 2	0.57±0.033	0.489±0.046	0.869±0.151	1.828±0.158	0.724±0.076	0.486±0.015	0.378±0.027	0.919±0.112	0.502±0.044	0.111±0.005	0.446±0.064	0.98±0.05	0.485±0.042	0.43±0.051	0.251±0.011	0.488±0.031
QPP Inbred 3	0.722±0.071	0.449±0.038	0.985±0.208	2.258±0.011	0.797±0.052	0.504±0.037	0.457±0.062	1.052±0.16	0.557±0.06	0.133±0.005	0.49±0.073	1.014±0.003	0.53±0.065	0.531±0.047	0.274±0.012	0.538±0.051
QPP Inbred 4	0.67±0.066	0.454±0.001	0.908±0.053	2.33±0.044	0.935±0.036	0.486±0.017	0.424±0.031	0.969±0.172	0.591±0.04	0.14±0.006	0.463±0.013	1.059±0.085	0.521±0.033	0.523±0.005	0.293±0	0.527±0.014
QPP Inbred 5	0.599±0.045	0.427±0.011	0.8±0.014	2.07±0.083	0.803±0.027	0.523±0.014	0.414±0.05	1.073±0.135	0.491±0.008	0.11±0.004	0.476±0.063	1.131±0.049	0.504±0.042	0.467±0.028	0.273±0.052	0.52±0.015
QPP Inbred 6	0.684±0.089	0.448±0.036	0.801±0.011	2.016±0.02	0.803±0.071	0.546±0.012	0.47±0.034	1.128±0.055	0.563±0.047	0.104±0.005	0.514±0.062	1.167±0.017	0.539±0.033	0.497±0.046	0.309±0.023	0.564±0.041
QPP Inbred 7	1.045±0.031	0.546±0.024	1.512±0.033	2.847±0.074	1.13±0.105	0.539±0.016	0.62±0.013	1.674±0.024	0.61±0.007	0.127±0	0.698±0	1.211±0.029	0.696±0.033	0.622±0.005	0.386±0.039	0.641±0.002
QPP Inbred 8	0.951±0.087	0.638±0.017	1.27±0.021	2.603±0.158	1.033±0.091	0.606±0.023	0.656±0.068	1.726±0.251	0.65±0.02	0.154±0.002	0.692±0.102	1.367±0.075	0.73±0.114	0.646±0.058	0.392±0.074	0.717±0.036
QPP Inbred 9	0.617±0.065	0.424±0.055	0.64±0.007	1.766±0.132	0.782±0.009	0.512±0.037	0.414±0.026	1.034±0.103	0.485±0.018	0.106±0.014	0.451±0.034	1.027±0.093	0.485±0.046	0.461±0.027	0.274±0.015	0.525±0.038
QPP Inbred 10	0.643±0.023	0.454±0.066	0.785±0.039	1.906±0.115	0.867±0.018	0.525±0.026	0.48±0.022	1.155±0.05	0.551±0.016	0.132±0.006	0.534±0.04	1.045±0.035	0.523±0.022	0.471±0.034	0.327±0.022	0.561±0.038
QPP Inbred 11	0.636±0.016	0.496±0.064	0.888±0.149	2.049±0.041	0.736±0.071	0.49±0.004	0.436±0.001	1.046±0.028	0.644±0.04	0.131±0.005	0.484±0.022	1.112±0.02	0.527±0.017	0.584±0.011	0.296±0.018	0.541±0.012
QPP Inbred 12	0.843±0.021	0.488±0.032	0.88±0.056	2.311±0.06	0.87±0.035	0.535±0.006	0.49±0.001	1.258±0.026	0.635±0.015	0.141±0	0.548±0.023	1.192±0.018	0.603±0.009	0.596±0.001	0.353±0.012	0.605±0.001
QPP Hybrid 8	0.634±0.048	0.457±0.029	0.805±0.101	1.911±0.049	0.826±0.121	0.562±0.049	0.417±0.026	1.114±0.063	0.477±0.017	0.125±0.015	0.495±0.028	1.055±0.065	0.505±0.031	0.472±0.023	0.316±0.033	0.521±0.024
QPP Hybrid 9	0.667±0.039	0.444±0.057	0.865±0.087	1.972±0.083	0.856±0.103	0.535±0.028	0.451±0.027	1.202±0.063	0.469±0.045	0.128±0.019	0.525±0.026	1.051±0.039	0.52±0.033	0.483±0.027	0.309±0.026	0.529±0.029
QPP Hybrid 19	0.708±0.12	0.498±0.088	0.868±0.204	2.005±0.23	0.828±0.117	0.577±0.047	0.474±0.074	1.192±0.185	0.525±0.077	0.126±0.013	0.536±0.071	1.097±0.063	0.548±0.07	0.496±0.069	0.322±0.022	0.563±0.06
QPP Hybrid 20	0.73±0.065	0.513±0.058	0.981±0.137	2.128±0.117	0.946±0.045	0.582±0.037	0.512±0.036	1.327±0.082	0.558±0.047	0.138±0.017	0.571±0.026	1.136±0.057	0.591±0.031	0.54±0.033	0.331±0.012	0.583±0.04
QPP Hybrid 23	0.67±0.049	0.469±0.021	1.001±0.199	2.073±0.163	0.85±0.054	0.534±0.014	0.457±0.028	1.165±0.083	0.504±0.014	0.124±0.006	0.519±0.036	1.082±0.022	0.532±0.023	0.476±0.018	0.299±0.018	0.532±0.013
QPP Hybrid 25	0.624±0.014	0.517±0.04	0.895±0.135	1.998±0.074	0.839±0.084	0.548±0.03	0.421±0.011	1.03±0.032	0.536±0.042	0.132±0.012	0.474±0.012	1.059±0.05	0.513±0.035	0.482±0.024	0.293±0.016	0.542±0.024
QPP Hybrid 28	0.666±0.072	0.493±0.072	0.839±0.169	2.041±0.242	0.813±0.143	0.57±0.035	0.474±0.053	1.223±0.154	0.524±0.047	0.119±0.021	0.529±0.071	1.126±0.088	0.559±0.064	0.51±0.051	0.286±0.045	0.565±0.052
QPP Hybrid 30	0.705±0.065	0.509±0.041	0.813±0.094	2.048±0.098	0.817±0.01	0.542±0.035	0.472±0.025	1.214±0.106	0.539±0.039	0.143±0.022	0.534±0.029	1.121±0.076	0.557±0.04	0.528±0.034	0.307±0.024	0.562±0.029
QPP Hybrid 38	0.71±0.053	0.528±0.035	0.964±0.171	2.061±0.148	0.9±0.116	0.555±0.029	0.478±0.04	1.217±0.106	0.552±0.024	0.137±0.014	0.54±0.037	1.107±0.061	0.558±0.048	0.527±0.03	0.29±0.032	0.571±0.038
QPP Hybrid 43	0.702±0.067	0.51±0.046	0.97±0.186	2.073±0.131	0.819±0.087	0.52±0.017	0.474±0.022	1.175±0.072	0.589±0.03	0.149±0.019	0.533±0.033	1.109±0.044	0.546±0.023	0.55±0.04	0.301±0.022	0.55±0.013

Supplementary Table 1: Protein-Bound Amino Acid Values (g/100g) in Raw Kernel Flour. Protein-bound amino acid values of sixteen amino acids are recorded. Aspartate and asparagine (Asx), glutamine and glutamate (Glx), Serine, and Tryptophan are destroyed during acidic hydrolysis, the procedure used for amino acid quantification. Standard deviations were calculated by two-six biological replications, dependent on genotype. Lysine levels are shaded in gray.

	Ala	Arg	Asn	Asp	Gln	Glu	Gly	His	Ile	Leu
Popcorn Parent 4	0.0054±0.0008	0.0059±0.0004	0.0235±0.0027	0.004±0.0002	0.0001±0	0.0047±0.0002	0.0015±0.0003	0.0024±0.0003	0.0004±0.0001	0.0005±0
Popcorn Parent 3	0.0187±0.0011	0.0063±0.0003	0.0211±0	0.0101±0.0023	0.0031±0	0.0132±0.0037	0.0064±0.0003	0.0045±0	0.0007±0	0.001±0.0002
Popcorn Parent 1	0.0046±0.0016	0.0052±0.0001	0.0407±0.0034	0.0084±0.0023	0.0081±0.0061	0.0146±0.0034	0.0057±0.001	0.0045±0.0012	0.0005±0	0.0005±0
Popcorn Parent 2	0.0023±0.0004	0.0074±0.0015	0.0268±0.0024	0.0046±0.0013	0.0023±0.0005	0.0173±0.0025	0.0059±0.0013	0.0022±0.0005	0.0001±0	0.0002±0
B73	0.0072±0.0023	0.0072±0.0012	0.0295±0.0021	0.0155±0.0056	0.0035±0.001	0.0316±0.0031	0.0089±0.002	0.0029±0.001	0.0006±0.0001	0.0007±0.0001
CML154Q	0.0205±0.0068	0.0396±0.0019	0.0713±0.0078	0.1241±0.0088	0.0958±0.0366	0.1199±0.0146	0.0308±0.0011	0.0132±0.0026	0.0033±0.0013	0.0065±0.0032
K0326Y	0.0101±0.005	0.0295±0.0093	0.0704±0.0137	0.0711±0.0325	0.015±0.0153	0.0433±0.0237	0.0235±0.0073	0.0119±0.0045	0.0029±0.0026	0.0031±0.0027
QPP Inbred 1	0.0274±0.0198	0.0283±0.0004	0.0676±0.0059	0.1289±0.0022	0.099±0.0761	0.1588±0.053	0.0335±0.0005	0.0087±0.0019	0.0027±0.0024	0.0061±0.0046
QPP Inbred 10	0.0046±0.0003	0.0113±0.0014	0.0486±0.0012	0.029±0.0022	0.0047±0.0006	0.031±0.0016	0.0103±0.0004	0.0055±0.0019	0.001±0	0.0008±0
QPP Inbred 11	0.0339±0.0201	0.0417±0.0046	0.0443±0.0113	0.1151±0.0011	0.0787±0.0373	0.1855±0.0048	0.0434±0.0014	0.0101±0.002	0.002±0.0006	0.0055±0.0036
QPP Inbred 12	0.0931±0.0423	0.0346±0.0035	0.0422±0.0065	0.116±0.0058	0.0677±0.0228	0.1715±0.0277	0.0483±0.0062	0.0108±0.0004	0.0045±0	0.0133±0.0019
QPP Inbred 2	0.0152±0.0023	0.0292±0.0011	0.0682±0.0118	0.1067±0.0203	0.0511±0.0093	0.1248±0.0098	0.0335±0.0009	0.0078±0.0019	0.0008±0.0003	0.0023±0.0004
QPP Inbred 3	0.05±0.024	0.036±0.0009	0.0598±0.012	0.1332±0.0213	0.1658±0.0847	0.2007±0.0464	0.034±0.0019	0.0195±0.0006	0.0014±0.0005	0.006±0.0047
QPP Inbred 4	0.0532±0.0036	0.0409±0.0002	0.0548±0.008	0.1637±0.0131	0.1724±0.0445	0.2373±0.0174	0.0343±0.0002	0.019±0.0076	0.0029±0.0006	0.0102±0.0004
QPP Inbred 5	0.0176±0.0103	0.0336±0.0028	0.0598±0.0035	0.1047±0.0027	0.0819±0.0834	0.1398±0.0637	0.0315±0.0016	0.0114±0.0022	0.0013±0.0004	0.0034±0.0019
QPP Inbred 6	0.0114±0.0032	0.0354±0.0032	0.0442±0.0032	0.0766±0.0129	0.0227±0.0256	0.0949±0.0627	0.0352±0.0169	0.0093±0.002	0.002±0.0006	0.0021±0.0011
QPP Inbred 7	0.0637±0.0134	0.0551±0.0017	0.0667±0.0004	0.1561±0.0068	0.1082±0.0229	0.292±0.0241	0.0486±0.0003	0.0201±0.0004	0.0041±0.0003	0.0093±0.0011
QPP Inbred 8	0.0146±0.0035	0.0528±0.0065	0.0648±0.0049	0.0931±0.0379	0.0084±0.0092	0.0907±0.0473	0.0393±0.0082	0.0149±0.0027	0.001±0.0002	0.0012±0.0005
QPP Inbred 9	0.0041±0.0001	0.0182±0.0011	0.0369±0.0071	0.0214±0.0091	0.0051±0.0004	0.0362±0.0023	0.0151±0.0102	0.0048±0.0007	0.0015±0	0.0011±0
Tx807	0.0134±0.0011	0.0344±0.0004	0.0954±0.0035	0.1004±0.0065	0.0217±0.0085	0.0898±0.0075	0.0321±0.0007	0.0145±0.0014	0.0015±0.0002	0.0033±0.0004
Hybrid 19	0.0066±0.0011	0.0247±0.0058	0.0636±0.0114	0.0676±0.0189	0.0064±0.0054	0.0508±0.0228	0.0232±0.0062	0.0075±0.0022	0.0005±0.0001	0.0009±0.0004
Hybrid 20	0.0089±0.002	0.0235±0.0046	0.0704±0.0096	0.0721±0.0102	0.0075±0.0073	0.0535±0.0234	0.0251±0.0057	0.0077±0.0013	0.0006±0.0001	0.0008±0.0001
Hybrid 23	0.014±0.0036	0.0186±0.0054	0.0698±0.0079	0.1053±0.0158	0.0517±0.0423	0.0932±0.0262	0.0306±0.0011	0.0083±0.0032	0.001±0.0004	0.0028±0.0015
Hybrid 25	0.0167±0.009	0.0243±0.002	0.0629±0.0089	0.1068±0.0349	0.0702±0.0704	0.0932±0.0484	0.0279±0.0061	0.009±0.0023	0.0013±0.001	0.0036±0.0032
Hybrid 28	0.007±0.0014	0.0201±0.0059	0.0614±0.0081	0.0692±0.0253	0.0137±0.0173	0.0532±0.0281	0.0226±0.0071	0.0071±0.0015	0.0005±0	0.0009±0.0005
Hybrid 30	0.012±0.0044	0.0131±0.006	0.0576±0.0142	0.0688±0.0322	0.0214±0.0262	0.0648±0.036	0.0227±0.0098	0.0073±0.0022	0.0006±0.0001	0.0013±0.0008
Hybrid 38	0.0071±0.0023	0.0213±0.0081	0.0703±0.0122	0.0624±0.0226	0.0079±0.0089	0.0513±0.0222	0.0241±0.0074	0.0075±0.0024	0.0005±0.0001	0.0009±0.0002
Hybrid 43	0.0121±0.0033	0.0265±0.0063	0.0693±0.0124	0.0809±0.0207	0.0399±0.0433	0.0928±0.0404	0.0292±0.0049	0.0087±0.0021	0.0009±0.0001	0.0015±0.0005
Hybrid 8	0.0063±0.0012	0.0216±0.0043	0.0605±0.0081	0.0677±0.0215	0.0112±0.0101	0.0484±0.0261	0.0218±0.0081	0.0062±0.0016	0.0003±0	0.0008±0.0002
Hybrid 9	0.0068±0.0029	0.0171±0.0069	0.0635±0.0061	0.0646±0.0149	0.014±0.0198	0.0519±0.0223	0.0242±0.0045	0.0059±0.0019	0.0004±0.0001	0.0008±0.0004

Supplementary Table 2: Free Amino Acid Values (g/100g) in Raw Kernel Flour. Free amino acid values of all twenty amino acids are recorded. Standard deviations were calculated by two-six biological replications, dependent on genotype.

	Lys	Met	Phe	Pro	Ser	Trp	Thr	Tyr	Val	Cys
Popcorn Parent 4	0.0031±0.0005	0.0001±0	0.0006±0	0.0138±0.0009	0.0011±0.0001	0.0013±0	0.0008±0.0001	0.0024±0.0001	0.0011±0.0001	0.0001±0
Popcorn Parent 3	0.0038±0.0005	0.0002±0	0.002±0.0003	0.052±0.0046	0.0077±0.0004	0.0008±0	0.002±0	0.0032±0.0002	0.0015±0	0.0001±0
Popcorn Parent 1	0.0029±0.0001	0.0002±0.0001	0.0008±0.0001	0.0135±0.0073	0.0022±0.0008	0.001±0.0001	0.0009±0.0002	0.0021±0.0002	0.0011±0.0001	0.0001±0
Popcorn Parent 2	0.0028±0.0005	0.0001±0	0.0005±0.0001	0.0043±0.0031	0.0027±0.0012	0.0008±0.0001	0.0008±0.0002	0.0017±0.0002	0.0007±0	0.0001±0
B73	0.0029±0.0005	0.0004±0.0001	0.0011±0.0001	0.0393±0.0102	0.0021±0.0006	0.001±0.0002	0.0007±0.0002	0.0049±0.0024	0.0015±0.0001	0.0001±0
CML154Q	0.0266±0.0058	0.0029±0.0015	0.0094±0.0033	0.1691±0.0681	0.0151±0.009	0.0035±0.0009	0.0113±0.0051	0.0304±0.0082	0.0094±0.0032	0.0005±0
K0326Y	0.0214±0.01	0.0007±0.0007	0.0027±0.0019	0.0814±0.0286	0.0111±0.0081	0.0019±0.0003	0.0047±0.0031	0.0096±0.003	0.0045±0.0032	0.0002±0
QPP Inbred 1	0.0162±0.0071	0.0035±0.0032	0.0053±0.0034	0.1297±0.0423	0.0155±0.0108	0.0033±0.0024	0.0191±0.0156	0.0128±0.0063	0.0076±0.0041	0.0005±0.0003
QPP Inbred 10	0.006±0.0003	0.0001±0	0.0008±0	0.1015±0.0115	0.0009±0.0001	0.0025±0.0001	0.0018±0.0004	0.0047±0.0006	0.0017±0.0001	0.0001±0
QPP Inbred 11	0.0177±0.0028	0.0007±0.0005	0.0048±0.0006	0.1554±0.0323	0.0126±0.0046	0.0027±0.0011	0.0166±0.0017	0.0121±0.0017	0.0053±0.0022	0.0008±0.0001
QPP Inbred 12	0.0315±0.0079	0.0036±0.0007	0.0048±0	0.1205±0.0086	0.0335±0.006	0.002±0.0001	0.0317±0.0042	0.0092±0.0005	0.0116±0.0023	0.0011±0.0002
QPP Inbred 2	0.0123±0.0003	0.001±0.0008	0.0029±0.0009	0.1267±0.0177	0.0071±0.0023	0.0026±0.0006	0.0065±0.0002	0.0098±0.0029	0.0034±0.0005	0.0003±0
QPP Inbred 3	0.0226±0.0027	0.0016±0.0005	0.0055±0.0021	0.0986±0.0713	0.0238±0.0147	0.0043±0.0005	0.021±0.003	0.0174±0.0041	0.007±0.0027	0.0005±0.0001
QPP Inbred 4	0.0302±0.0037	0.0021±0.0006	0.0068±0.0001	0.1509±0.0013	0.0255±0.0052	0.0034±0.0005	0.0286±0.0059	0.0182±0.0017	0.0111±0.0015	0.0009±0.0001
QPP Inbred 5	0.0155±0.0064	0.0018±0.0012	0.0039±0.0016	0.1041±0.0349	0.0105±0.0043	0.0023±0.0003	0.0085±0.0032	0.0085±0.0024	0.0052±0.0022	0.0003±0.0001
QPP Inbred 6	0.0141±0.0055	0.0007±0.0003	0.0024±0.001	0.1116±0.0352	0.0058±0.0003	0.0027±0.0004	0.0049±0.0021	0.007±0.0015	0.0043±0.0022	0.0004±0.0002
QPP Inbred 7	0.0486±0.0072	0.0055±0.0007	0.0066±0.0011	0.112±0.0118	0.0384±0.0033	0.0044±0.0004	0.0344±0.0006	0.0217±0.0002	0.0156±0.0001	0.0004±0.0002
QPP Inbred 8	0.0257±0.0079	0.0008±0.0008	0.0022±0.0016	0.0809±0.0173	0.0052±0.0031	0.0032±0.0006	0.0059±0.0046	0.0101±0.004	0.0026±0.0017	0.0004±0.0003
QPP Inbred 9	0.0089±0.0019	0.0001±0	0.0011±0.0004	0.0853±0.0183	0.0014±0.0008	0.0017±0.0001	0.0021±0.0002	0.005±0.0004	0.0023±0	0.0001±0
Tx807	0.0254±0.0013	0.0006±0.0001	0.0054±0.0001	0.0385±0.006	0.0107±0.0011	0.0028±0.0002	0.0112±0.0015	0.0134±0.0014	0.005±0.0005	0.0004±0
Hybrid 19	0.0116±0.0025	0.0002±0	0.0019±0.0008	0.0717±0.0161	0.0028±0.0016	0.0027±0.0004	0.0035±0.0022	0.0065±0.0015	0.0019±0.0005	0.0001±0
Hybrid 20	0.0126±0.0016	0.0002±0	0.0021±0.0006	0.078±0.023	0.0028±0.0015	0.003±0.0004	0.0037±0.0015	0.0087±0.0024	0.0022±0.0003	0.0001±0
Hybrid 23	0.0115±0.004	0.0006±0.0004	0.0047±0.0023	0.1035±0.0246	0.0078±0.005	0.0029±0.0005	0.0096±0.0056	0.0122±0.0035	0.0041±0.0015	0.0003±0.0001
Hybrid 25	0.015±0.005	0.0007±0.0007	0.0049±0.0032	0.0957±0.0256	0.0096±0.0095	0.0035±0.0003	0.0094±0.0081	0.0166±0.0087	0.0051±0.0034	0.0003±0.0001
Hybrid 28	0.0123±0.0024	0.0002±0	0.0017±0.0011	0.0686±0.0188	0.0027±0.0016	0.0024±0.0001	0.0033±0.0023	0.0076±0.0029	0.0021±0.0006	0.0001±0
Hybrid 30	0.0085±0.0025	0.0002±0.0001	0.0023±0.0013	0.1095±0.0128	0.0038±0.0032	0.0024±0.0004	0.005±0.0039	0.0121±0.0049	0.0026±0.0014	0.0002±0
Hybrid 38	0.0137±0.0033	0.0001±0	0.0017±0.0011	0.0673±0.0102	0.0025±0.0015	0.0029±0.0005	0.0032±0.0015	0.0089±0.0033	0.0019±0.0003	0.0002±0
Hybrid 43	0.0153±0.0048	0.0003±0.0001	0.0034±0.0013	0.106±0.0285	0.0042±0.0023	0.0031±0.0003	0.0055±0.0036	0.0143±0.0037	0.003±0.0007	0.0002±0.0001
Hybrid 8	0.0096±0.0016	0.0001±0	0.0021±0.0014	0.0655±0.0176	0.0023±0.0014	0.0022±0.0005	0.0032±0.0016	0.006±0.0028	0.0015±0.0002	0.0002±0
Hybrid 9	0.0096±0.0036	0.0002±0.0001	0.0016±0.0008	0.0505±0.0172	0.0026±0.0015	0.0025±0.0003	0.0038±0.0022	0.0063±0.0021	0.002±0.0006	0.0002±0

Supplementary Table 2 Continued: Free Amino Acid Values (g/100g) in Raw Kernel Flour. Free amino acid values of all twenty amino acids are recorded. Standard deviations were calculated by two-six biological replications, dependent on genotype.

	Hybrid	Germination Rate	Days to Pollinating	Rot Susceptibility	Number of Ears Harvested	Ear Length	Number of Rows per Ear	Ear Weight	Kernel Size	Vitreousness Level	Hundred Grain Weight	Pop-Ability	Expansion Volume
	1	-0.037	2.076	-0.022	-1.142	-3.261	-1.841	-18.283	10.831	0.855	-1.686	0.016	94.932
	2	-0.270	2.976	0.024	-4.236	-1.642	-2.027	-25.041	16.319	0.395	-2.060	0.005	99.905
	3	0.140	-1.004	0.053	0.081	-1.501	-0.167	-5.694	2.639	-0.595	-0.528	-0.002	-8.857
	4	0.097	1.163	0.036	0.297	-1.666	-0.034	-3.716	3.886	-0.025	-0.727	0.002	-17.113
	5	-0.078	3.825	0.028	-2.221	-4.573	-2.370	-29.536	27.055	0.316	-2.879	0.017	112.069
	6	-0.510	1.422	-0.013	-5.603	-2.622	-1.195	-2.570	-1.981	-0.074	0.049	0.006	3.366
	7	0.104	2.304	-0.049	1.089	-2.909	-0.581	-14.350	16.520	-0.106	-2.071	0.010	52.473
	8	0.160	-1.797	-0.047	1.808	2.376	0.546	9.909	-2.967	0.903	0.270	0.010	28.098
	9	0.128	-0.472	0.019	0.801	2.345	0.621	8.096	-1.805	0.819	0.111	0.020	71.737
	10	0.202	-0.810	0.020	0.945	-1.237	0.223	-6.276	5.986	-0.908	-0.947	-0.003	-59.179
	11	0.197	0.175	0.067	1.089	-1.711	-0.997	-7.679	0.038	-0.166	-0.245	-0.059	-100.851
	12	0.114	2.418	0.022	0.153	-4.015	-2.575	-23.254	10.553	0.382	-1.495	0.006	85.890
	13	0.061	3.368	-0.010	0.657	-1.715	-1.782	-19.941	9.818	0.198	-1.264	0.015	53.259
	14	0.135	-0.852	0.078	0.585	-1.687	-0.293	-7.342	2.226	-1.077	-0.491	-0.004	-18.292
	15	0.165	0.517	0.063	1.376	-3.159	0.116	-9.107	9.699	-0.209	-1.124	-0.008	-10.429
	16	-0.027	3.140	-0.004	-1.142	-3.597	-2.476	-29.301	31.190	0.791	-3.200	0.022	119.700
	17	0.162	1.962	0.027	1.017	-2.324	-0.533	-8.613	-0.029	-0.077	-0.210	0.013	28.491
	18	0.129	2.342	0.013	0.009	-2.745	-0.925	-16.935	15.242	0.043	-1.838	0.021	74.095
	19	0.141	-2.677	0.035	2.168	2.127	-0.225	9.178	-6.284	0.668	0.716	0.015	35.934
	20	0.157	-2.487	0.028	1.520	2.637	0.204	6.771	-5.455	0.717	0.710	0.019	50.114
	21	0.046	-0.624	0.030	0.009	-1.884	-0.298	-6.388	1.070	-0.642	-0.267	-0.003	-29.693
	22	0.139	-0.244	0.120	0.585	-1.528	-0.645	-4.402	-2.503	0.044	0.265	-0.038	-56.820
	23	0.040	-1.042	0.002	1.664	0.943	-0.725	12.595	-10.644	-0.262	1.591	-0.032	-30.873
	24	-0.168	-0.092	-0.013	-0.782	1.795	-0.287	9.770	-6.910	-0.378	0.970	-0.013	-34.411
	25	0.051	-1.156	-0.075	1.880	1.637	1.413	16.628	-7.374	-0.191	0.937	-0.001	-39.129
	26	0.029	0.479	-0.055	0.081	1.068	1.838	17.377	-8.543	-0.436	1.094	-0.010	-54.068
	27	-0.138	-1.427	-0.101	-0.830	2.318	-0.661	7.919	-8.657	0.646	1.153	-0.003	-8.464
	28	0.030	-2.826	0.072	1.376	2.702	-0.586	9.367	-6.365	0.929	0.668	0.014	48.935
	29	-0.037	-0.320	-0.023	-0.494	3.106	0.492	16.712	-15.752	-0.652	2.548	-0.012	-76.084
	30	0.055	0.897	-0.001	0.729	2.061	-0.362	4.791	-2.810	-0.246	0.176	-0.009	2.151
	31	-0.205	-0.814	-0.075	-1.286	1.223	0.849	-6.119	4.893	0.091	-0.657	0.018	-14.754
	32	-0.006	-0.510	-0.079	0.801	1.141	1.718	18.423	-9.479	-0.355	1.244	-0.014	-69.400
	33	-0.054	-0.890	-0.113	0.873	3.313	1.427	18.797	-9.928	0.213	1.740	-0.046	-109.500
	34	0.093	-2.753	0.034	1.520	1.175	0.204	11.252	-11.778	-1.359	1.912	-0.017	-67.435
	35	-0.153	0.061	0.016	-0.998	0.505	0.920	8.333	-5.632	-1.206	0.859	-0.028	-76.084
	36	-0.268	-0.966	-0.025	-1.646	1.139	1.787	7.619	-4.281	-0.635	0.503	0.014	-24.976
	37	-0.247	0.669	0.017	-1.430	-0.497	1.475	2.915	-2.226	-0.224	0.206	0.003	-21.830
	38	0.144	-2.411	0.065	1.448	1.603	0.151	5.027	-4.594	1.098	0.312	0.023	57.977
	39	-0.121	-0.481	-0.020	-0.782	1.752	0.140	1.746	-2.834	0.956	0.154	0.022	68.198
	40	-0.185	0.061	-0.036	-1.933	1.563	1.101	4.903	-9.084	-0.349	1.252	0.012	-26.155
	41	-0.079	-1.194	-0.017	-0.351	1.420	0.693	5.212	-4.896	-0.545	0.426	-0.009	-15.933
	42	-0.169	0.061	-0.039	-1.646	0.571	1.405	-0.890	-1.759	0.310	0.150	0.002	-26.155
	43	0.084	-1.139	-0.017	1.592	1.000	2.265	11.506	-3.534	0.006	0.360	-0.006	-56.820
	44	-0.048	-0.928	-0.036	0.369	2.752	1.998	20.589	-9.862	0.340	1.316	0.013	-34.018
Standard Error		0.006	0.772	0.002	0.731	1.17	0.366	41.73	23.967	0.0874	4.444	0.0001	862.378
Genetic Repeatability		0.566	0.465	0.078	0.345	0.716	0.673	0.728	0.676	0.684	0.683	0.201	0.582

Supplementary Table 3: Specific Combining Ability (SCA) and genetic repeatability estimates for all recorded traits. Specific Combining Ability and genetic repeatability estimates were found with ASReml-R software. High SCAs were noted in elite hybrids, shaded in gray. High repeatabilities were calculated for ear length and ear weight.

	Ala	Arg	Asx	Glx	Gly	His	Ile	Leu	Lys	Met	Phe	Pro	Ser	Thr	Tyr	Val
Popcorn Parent 4	1.254± 0.144	0.365± 0.061	0.807± 0.057	3.085± 0.087	1.159± 0.076	0.451± 0.022	0.783± 0.073	2.48± 0.194	0.206± 0.043	0.193± 0.029	0.809 ±0.033	1.291± 0.091	0.773± 0.074	0.6± 0.071	0.486 ±0.053	0.66± 0.044
Popcorn Parent 3	1.056± 0.024	0.31± 0.024	0.7± 0.031	2.591± 0.092	0.909± 0.018	0.402± 0.009	0.659± 0.029	2.006± 0.117	0.173± 0.017	0.196± 0.005	0.698± 0.018	1.168± 0.06	0.667± 0.023	0.547± 0.034	0.445± 0.031	0.555± 0.018
Popcorn Parent 1	1.248± 0.037	0.379± 0.022	0.795± 0.026	3.077± 0.165	1.089± 0.016	0.499± 0.017	0.755± 0.053	2.388± 0.148	0.197± 0.013	0.259± 0.035	0.788± 0.025	1.386± 0.054	0.783± 0.048	0.616± 0.027	0.515± 0.043	0.65± 0.026
Popcorn Parent 2	0.991± 0.1	0.295± 0.021	0.662± 0.04	2.58± 0.139	1.003± 0.107	0.391± 0.018	0.642± 0.038	1.978± 0.152	0.201± 0.028	0.182± 0.015	0.707± 0.035	1.146± 0.052	0.642± 0.047	0.484± 0.054	0.425± 0.024	0.527± 0.029
QPP Hybrid 20	0.752± 0.052	0.514± 0.038	0.852± 0.122	2.234± 0.188	0.862± 0.139	0.552± 0.024	0.54± 0.038	1.342± 0.099	0.402± 0.024	0.128± 0.006	0.603± 0.04	1.128± 0.05	0.59± 0.032	0.527± 0.029	0.322± 0.037	0.628± 0.036
QPP Hybrid 25	0.709± 0.066	0.494± 0.078	0.973± 0.219	2.24± 0.171	0.936± 0.127	0.553± 0.054	0.501± 0.047	1.164± 0.086	0.37± 0.065	0.135± 0.023	0.532± 0.043	1.113± 0.079	0.556± 0.066	0.508± 0.039	0.294± 0.045	0.609± 0.061
QPP Hybrid 28	0.872± 0.079	0.558± 0.072	0.829± 0.119	2.57± 0.229	0.935± 0.151	0.614± 0.027	0.622± 0.051	1.581± 0.164	0.358± 0.061	0.137± 0.012	0.672± 0.069	1.297±0.0 67	0.653± 0.05	0.571± 0.041	0.39± 0.061	0.708± 0.048
QPP Hybrid 38	0.713± 0.03	0.553± 0.057	0.778± 0.11	2.189± 0.103	1.282± 0.137	0.644± 0.05	0.517± 0.025	1.359± 0.058	0.371± 0.04	0.117± 0.011	0.555± 0.029	1.26± 0.049	0.554± 0.04	0.519± 0.031	0.338± 0.025	0.617± 0.035
QPP Hybrid 43	0.758± 0.087	0.63± 0.155	0.915± 0.248	2.348± 0.32	1.292± 0.096	0.641± 0.094	0.546± 0.086	1.326± 0.175	0.42± 0.077	0.148± 0.025	0.559± 0.058	1.269± 0.121	0.599± 0.099	0.571± 0.068	0.357± 0.044	0.651± 0.097

Supplementary Table 4: Protein-Bound Amino Acid Levels (g/100g) in Air Popped Flakes. Protein-bound amino acid values of sixteen amino acids in air popped flakes are recorded. Aspartate and asparagine (Asx), glutamine and glutamate (Glx), Serine, and Tryptophan are destroyed during acidic hydrolysis, the procedure used for amino acid quantification. Only five QPP hybrids and four popcorn parents were tested with air popping. Standard deviations were calculated by four biological replications.

	Ala	Arg	Asx	Glx	Gly	His	Ile	Leu	Lys	Met	Phe	Pro	Ser	Thr	Tyr	Val
Popcorn Parent 1	1.314±0.085	0.336±0.039	0.838±0.091	3.185±0.264	1.101±0.122	0.502±0.04	0.823±0.091	2.555±0.285	0.176±0.024	0.274±0.025	0.821±0.071	1.431±0.115	0.776±0.059	0.612±0.068	0.537±0.08	0.679±0.066
Popcorn Parent 2	0.967±0.054	0.249±0.031	0.614±0.073	2.485±0.163	0.843±0.092	0.38±0.027	0.603±0.062	1.917±0.123	0.155±0.014	0.171±0.01	0.668±0.047	1.098±0.056	0.593±0.058	0.451±0.041	0.374±0.043	0.506±0.044
QPP Hybrid 20	0.849±0.052	0.504±0.073	0.872±0.079	2.479±0.154	0.911±0.14	0.582±0.042	0.608±0.063	1.517±0.165	0.357±0.078	0.148±0.025	0.662±0.064	1.22±0.087	0.632±0.06	0.565±0.059	0.353±0.042	0.682±0.063
QPP Hybrid 25	0.748±0.044	0.466±0.041	0.831±0.084	2.325±0.056	0.982±0.127	0.568±0.021	0.524±0.033	1.255±0.045	0.313±0.011	0.138±0.016	0.569±0.017	1.138±0.057	0.558±0.035	0.524±0.025	0.31±0.022	0.64±0.035
QPP Hybrid 28	0.715±0.075	0.506±0.062	0.688±0.119	2.195±0.168	1.196±0.017	0.658±0.031	0.511±0.06	1.345±0.121	0.287±0.038	0.117±0.012	0.527±0.063	1.2±0.034	0.537±0.059	0.502±0.051	0.32±0.056	0.596±0.056
QPP Hybrid 38	0.695±0.054	0.558±0.059	0.788±0.108	2.099±0.136	1.197±0.034	0.593±0.061	0.503±0.028	1.268±0.115	0.334±0.031	0.118±0.012	0.53±0.033	1.163±0.096	0.545±0.044	0.509±0.034	0.317±0.034	0.591±0.034
QPP Hybrid 43	0.726±0.077	0.577±0.024	0.869±0.114	2.276±0.222	1.253±0.054	0.627±0.06	0.527±0.046	1.301±0.139	0.353±0.074	0.139±0.022	0.538±0.05	1.216±0.078	0.548±0.049	0.532±0.019	0.331±0.045	0.622±0.062

Supplementary Table 5: Protein-Bound Amino Acid Levels (g/100g) in Microwaved Popped Flakes. Protein-bound amino acid values of sixteen amino acids in microwave-popped flakes are recorded. Aspartate and asparagine (Asx), glutamine and glutamate (Glx), Serine, and Tryptophan are destroyed during acidic hydrolysis, the procedure used for amino acid quantification. Only five QPP hybrids and two popcorn parents were tested with air popping. Standard deviations were calculated by four biological replications.

	Ala	Arg	Asx	Glx	Gly	His	Ile	Leu	Lys	Met	Phe	Pro	Ser	Thr	Tyr	Val
Popcorn Parent 1	0.897± 0.195	0.267± 0.021	0.601± 0.083	2.269± 0.389	0.773± 0.172	0.364± 0.044	0.529± 0.114	1.751± 0.358	0.188± 0.022	0.179± 0.046	0.625± 0.102	1.067± 0.176	0.575± 0.101	0.459± 0.077	0.38±0. 089	0.48±0. 076
Popcorn Parent 2	0.855± 0.146	0.296± 0.073	0.635± 0.158	2.187± 0.422	0.745± 0.187	0.351± 0.076	0.548± 0.136	1.662± 0.338	0.23±0. 082	0.152± 0.033	0.63±0. 116	0.969± 0.17	0.571± 0.115	0.454± 0.099	0.354± 0.108	0.503± 0.116
QPP Hybrid 20	0.611±0 .078	0.379± 0.025	0.672± 0.101	1.8± 0.24	0.77± 0.08	0.474± 0.05	0.428± 0.046	1.076± 0.154	0.266± 0.018	0.098± 0.007	0.487± 0.06	0.945± 0.103	0.475± 0.064	0.414± 0.035	0.269± 0.018	0.519± 0.05
QPP Hybrid 25	0.543± 0.051	0.363± 0.097	0.686± 0.12	1.78± 0.192	0.645± 0.098	0.481± 0.059	0.391± 0.047	0.927± 0.078	0.28±0. 05	0.097± 0.01	0.425± 0.049	0.894± 0.089	0.426± 0.06	0.398± 0.037	0.239± 0.038	0.503± 0.058
QPP Hybrid 28	0.565± 0.105	0.485± 0.135	0.586± 0.088	1.675± 0.224	1.014± 0.151	0.499± 0.036	0.396± 0.058	0.989± 0.151	0.273± 0.027	0.088± 0.014	0.434± 0.062	0.935± 0.083	0.433± 0.053	0.399± 0.027	0.245± 0.039	0.488± 0.053
QPP Hybrid 38	0.62±0. 088	0.487± 0.013	0.677± 0.055	1.807± 0.324	1.117±0 .107	0.529± 0.098	0.437± 0.057	1.123± 0.238	0.264± 0.016	0.102± 0.012	0.481± 0.056	0.983± 0.225	0.496± 0.05	0.448± 0.041	0.29±0. 067	0.529± 0.054
QPP Hybrid 43	0.662± 0.023	0.567± 0.061	0.823± 0.191	2.007± 0.155	1.141± 0.076	0.589± 0.048	0.466± 0.021	1.152± 0.059	0.345± 0.077	0.117±0 .006	0.493± 0.022	1.089± 0.079	0.509± 0.042	0.495± 0.048	0.26±0. 016	0.561± 0.034

Supplementary Table 6: Protein-Bound Amino Acid Levels (g/100g) in Oil Popped Flakes. Protein-bound amino acid values of sixteen amino acids in oil-popped flakes are recorded. Aspartate and asparagine (Asx), glutamine and glutamate (Glx), serine, and tryptophan are destroyed during acidic hydrolysis, the procedure used for protein-bound amino acid quantification. Only five QPP hybrids and two popcorn parents were tested with air popping. Standard deviations were calculated by four biological replications.

	Ala	Arg	Asn	Asp	Gln	Glu	Gly	His	Ile	Leu	Lys	Met	Phe	Pro	Ser	Trp	Thr	Tyr	Val	Cys
Popcorn Parent 4	0.000806 ±0.00028	0.00121± 0.000196	0.00133± 0.00111	0.000792 ±0.0003	0±0	0.000194 ±0.00010	0.000823 ±0.00041	0.000599 ±0.00015	0.0000868 ±0.00000 173	0.0000288 ±0.00004 98	0.000642 ±0.00024	0±0	0.000109 ±0.00000 218	0.00137± 0.000914	0.000278 ±0.00006 62	0.000135 ±0.00000 269	0.000211 ±0.00009 61	0.0000791 ±0.00006 85	0.0000257 ±0.00004 45	0.0000539 ±0.00004 67
Popcorn Parent 3	0.00119± 0.0000386	0.00128± 0.000163	0.0014±0. 000284	0.00331± 0.000461	0±0	0.000795 ±0.00015 1	0.00196± 0.0019	0.00113± 0.0000851	0.000085 ±0.00000 0498	0.000114 ±0.00005	0.00115± 0.000369	0±0	0.00025± 0.0000634	0.00996± 0.00355	0.000705 ±0.00016 2	0.000132 ±0.00000 0775	0.00155± 0.000955	0.000313 ±0.00006 9	0.0000759 ±0.00000 0445	0.0000522 ±0.00004 52
Popcorn Parent 1	0.000764 ±0.00022	0.00149± 0.00017	0.00472± 0.000973	0.0022±0. 00037	0±0	0.00067± 0.000207	0.00146± 0.000794	0.000742 ±0.00013 3	0.0000666 ±0.00004 44	0.0000667 ±0.00004 45	0.000738 ±0.00009 11	0.0000247 ±0.00004 95	0.000111 ±0.00000 172	0.00258± 0.000852	0.000337 ±0.00010 7	0.000138 ±0.00000 213	0.000141 ±0.00004 13	0.000122 ±0.00000 189	0.0000596 ±0.00003 97	0.0000817 ±0.00000 126
Popcorn Parent 2	0.000512 ±0.00012	0.00132± 0.000171	0.00365± 0.00201	0.00199± 0.000666	0±0	0.0012±0. 000591	0.00115± 0.00059	0.000657 ±0.00021	0.0000647 ±0.00004	0.0000864 ±0.00000 123	0.000753 ±0.00021	0±0	0.000109 ±0.00000 155	0.00192± 0.00114	0.000519 ±0.00012	0.000168 ±0.00006 46	0.000137 ±0.00003 81	0.000239 ±0.00000 34	0.0000575 ±0.00003 84	0.0000798 ±0.00000 114
QPP Hybrid 20	0.00235± 0.000557	0.00993± 0.00437	0.0277±0. 00573	0.0305±0. 0109	0±0	0.0076±0. 00541	0.00361± 0.00244	0.00206± 0.000355	0.00011± 0.0000469	0.000152 ±0.00007 94	0.00314± 0.000935	0.0000242 ±0.00004 84	0.000518 ±0.00038	0.0296±0. 0126	0.000697 ±0.00034	0.00068± 0.000239	0.00645± 0.00226	0.00201± 0.000953	0.000487 ±0.00012 2	0.000221 ±0.00007 29
QPP Hybrid 25	0.00536± 0.00225	0.00833± 0.00149	0.0337±0. 00797	0.0581±0. 013	0.0000712 ±0.00014	0.015±0.0 0615	0.00647± 0.00183	0.00318± 0.000803	0.000321 ±0.00023	0.0015±0. 00132	0.00457± 0.00112	0.000244 ±0.00017	0.00245± 0.00147	0.0421±0. 0159	0.00458± 0.0044	0.00133± 0.000274	0.0103±0. 00426	0.00936± 0.00542	0.0021±0. 00165	0.000237 ±0.00011
QPP Hybrid 28	0.00177± 0.000798	0.00675± 0.00361	0.0197±0. 00976	0.0265±0. 0174	0±0	0.00412± 0.00562	0.00207± 0.00263	0.00186± 0.000655	0.0000427 ±0.00005	0.000129 ±0.00008 27	0.00247± 0.000967	0±0	0.000348 ±0.00041	0.0199±0. 0161	0.000636 ±0.00043	0.000433 ±0.00042	0.00411± 0.00427	0.00148± 0.00159	0.000287 ±0.00026	0.000198 ±0.00015
QPP Hybrid 38	0.00234± 0.000545	0.00481± 0.0026	0.0244±0. 00603	0.034±0.0 107	0±0	0.00415± 0.00179	0.00256± 0.00184	0.00176± 0.000496	0.0000867 ±0.00000 114	0.000109 ±0.00004 39	0.00271± 0.000944	0±0	0.000465 ±0.00029	0.0267±0. 0123	0.000607 ±0.00023	0.000641 ±0.00017	0.00688± 0.0029	0.00165± 0.000541	0.000465 ±0.00011	0.000279 ±0.00015
QPP Hybrid 43	0.00402± 0.0017	0.00738± 0.00441	0.0259±0. 0146	0.0376±0. 0218	0.0000735 ±0.00009 45	0.011±0.0 105	0.00467± 0.00392	0.00234± 0.000952	0.000198 ±0.00017	0.000441 ±0.00060	0.00376± 0.00228	0.000125 ±0.00019	0.00127± 0.00116	0.0525±0. 0181	0.00178± 0.00193	0.000817 ±0.00040	0.0137±0. 00617	0.00432± 0.00275	0.00104± 0.00109	0.000649 ±0.00044

Supplementary Table 7: Free Amino Acid Levels (g/100g) in Air Popped Flakes. Free amino acid values of all twenty amino acids are recorded. As shown, all free amino acids substantially decline in abundance after popping. The five elite QPP hybrids and four popcorn parents were popped by air. Standard deviations were calculated by four biological replications of each genotype.

	Ala	Arg	Asn	Asp	Gln	Glu	Gly	His	Ile	Leu	Lys	Met	Phe	Pro	Ser	Trp	Thr	Tyr	Val	Cys
Popcorn Parent 1	0.0009482463±0.0002365559	0.0017418 48±0.0004865403	0.0052037 587±0.0020342478	0.0022507 094±0.0007099502	0±0	0.0003721 632±0.0001004849	0.0018393 288±0.0008881289	0.0007413 003±0.0001857273	0.0000224 9914±0.00004499828	0.0000224 6062±0.00004492123	0.0008330 781±0.0002889226	0.0000242 224±0.00004844481	0.0001111 534±0.00002824104	0.0037565 672±0.001144277	0.0002834 253±0.00006064005	0.0001042 685±0.00006952621	0.0002011 72±0.00008390191	0.0000925 0559±0.0001006816826	0.0000598 1031±0.0003988114	0.0000815 2643±0.00000207136 3
Popcorn Parent 2	0.0004314 31±0.0001754707	0.0011925 1±0.0002272991	0.0009401 704±0.0002164053	0.0007320 231±0.0001078965	0±0	0.0001904 881±0.0000027130 75	0.0005427 041±0.0006295066	0.0005418 658±0.0001880436	0±0	0.0000638 5784±0.00004258655	0.0005316 34±0.0001499558	0±0	0.0001069 351±0.00001523051	0.0006483 133±0.0005851235	0.0002383 546±0.00004142166	0.0001322 075±0.00001882999	0.0000771 1189±0.0001098290	0.0000882 0921±0.0005882639	0±0	0.0000784 3248±0.00000111709
QPP Hybrid 20	0.0026273 338±0.0005253412	0.0052710 28±0.0009995258	0.0236457 545±0.0043510332	0.0333104 174±0.0066603816	0±0	0.0024168 42±0.0013 0196	0.0022047 871±0.0015269503	0.0019492 611±0.0003685865	0.0001074 379±0.00004478807	0.0002569 593±0.0000009933126	0.0023867 759±0.0002357523	0±0	0.0006469 428±0.0002638239	0.0241894 477±0.007442605	0.0007720 446±0.0002609134	0.0005334 992±0.0001889074	0.0047557 81±0.0017 10336	0.0027793 87±0.0006 441274	0.0004977 861±0.0001606601	0.0001584 233±0.00006633965
QPP Hybrid 25	0.0045106 601±0.0024204423	0.0061511 39±0.0019706678	0.0261335 466±0.0071172068	0.0394566 982±0.0137240549	0.0000475 3136±0.0000548916	0.0028958 854±0.001 870876	0.0029132 709±0.001 264521	0.0023100 025±0.0007745874	0.0001692 952±0.0002281432	0.0008056 195±0.0002959592	0.0029598 845±0.0009597532	0.0001446 011±0.0001659447	0.0014719 689±0.001014932	0.0242898 97±0.0042562222	0.0028388 085±0.0031573153	0.0008609 623±0.0003166468	0.0049458 29±0.0015 69736	0.0056358 69±0.0036 78759	0.0010996 31±0.0010 51773	0.0001375 024±0.00003958659
QPP Hybrid 28	0.0022881 962±0.0004643949	0.0031461 65±0.0009619635	0.0175810 897±0.0045551998	0.0250493 416±0.0076961613	0±0	0.0018119 86±0.0006 98582	0.0027110 223±0.0028351934	0.0016151 557±0.0004004456378	0.0000657 1855±0.00004389156	0.0001755 595±0.0000001256886	0.0022014 835±0.0008007000656	0.0000252 8983±0.0000500579664	0.0005790 401±0.0004761225	0.0138389 265±0.0048636911	0.0008664 472±0.0048493801	0.0004778 727±0.0001751826	0.0031735 39±0.0015 45485	0.0017192 9±0.00111 8404	0.0004122 344±0.0002708196	0.0001418 729±0.00004030057
QPP Hybrid 38	0.0020741 728±0.0007131781	0.0035095 22±0.0014794624	0.0231666 703±0.0081097997	0.0265255 607±0.0124497166	0±0	0.0021857 841±0.001 273317	0.0013758 317±0.0010168604	0.0015060 134±0.0004004024	0.0000856 4974±0.00001609564	0.0001074 94±0.00008178895	0.0021156 913±0.0005635579	0±0	0.0004596 332±0.0002973852	0.0155259 675±0.0060488209	0.0005322 905±0.0043029079	0.0004681 73±0.0001 38271	0.0036566 42±0.0016 46911	0.0015146 08±0.0009 443404	0.0002495 89±0.0001 314453	0.0001388 724±0.00004101482
QPP Hybrid 43	0.0054818 223±0.0032600120	0.0063161 67±0.0027925839	0.0264189 24±0.011697761	0.0374209 989±0.0220457084	0.0002341 987±0.0004004683974	0.0086145 505±0.012 31544	0.0031117 14±0.0032355611	0.0026129 592±0.0014820626	0.0001697 118±0.00001180368	0.0004661 569±0.0004004436924	0.0039654 384±0.0021068802	0.0001680 829±0.0002261091	0.0013354 26±0.0009928845	0.0406693 458±0.0252109382	0.0021879 253±0.002176686	0.0009253 966±0.0005606712	0.0093394 66±0.0069 71784	0.0046027 06±0.0030 60331	0.0010957 81±0.0011 52142	0.0000391 1748±0.00004517136

Supplementary Table 8: Free Amino Acid Levels (g/100g) in Microwave Popped Flakes. Free amino acid values of all twenty amino acids in microwave-popped flakes are recorded. As shown, all free amino acids substantially decline in abundance after popping. The five elite hybrids and two popcorn parents were popped with microwave and oil popping methods. Standard deviations were calculated by four biological replications of each genotype.

	Ala	Arg	Asn	Asp	Gln	Glu	Gly	His	Ile	Leu	Lys	Met	Phe	Pro	Ser	Trp	Thr	Tyr	Val	Cys
	0.000605	0.0013612	0.0075552	0.0020541		0.0008027	0.0010705	0.0006586		0.0000651	0.0007262	0.0001959	0.0001093	0.0032155	0.0002608	0.0001351	0.0001193	0.0001199	0.0000775	0.0000801
	5715±0.0	82±0.0003	73±0.0013	6±0.00047		696±0.000	21±0.0008	571±0.000		3198±0.00	074±0.000	22±0.0001	286±0.000	498±0.000	39±0.0000	667±0.000	118±0.000	18±0.0000	3404±0.00	88±0.0000
Popcorn Parent 1	00089926	79367	26479	04377	0±0	1185045	517239	1731321	0±0	00434933	1781827	364582	00315079	9254667	3583853	00389543	0796212	03455971	00022345	02310975
	0.000478	0.0015033	0.0041520	0.0010354		0.0007145	0.0012058	0.0006785	0.0000213	0.0000633	0.0006798		0.0001071	0.0009911	0.0004248	0.0000985	0.0001731	0.0001164	0.0000378	0.0000588
	017±0.00	35±0.0002	39±0.0024	01±0.0004		323±0.000	14±0.0003	01±0.0001	6319±0.00	0407±0.00	674±0.000		172±0.000	009±0.001	041±0.000	6362±0.00	916±0.000	347±0.000	238±0.000	331±0.000
Popcorn Parent 2	02365074	000403	50013	524599	0±0	3522831	073448	855328	00427264	00422092	1704428	0±0	00188884	300758	2161146	00657193	07290276	09468833	04367861	03924577
	0.001770	0.0050627	0.0197823	0.0273530		0.0043415	0.0027494	0.0015724	0.0000662	0.0002200	0.0017294	0.0000253	0.0006376	0.0137838	0.0006703	0.0005126	0.0027059	0.0019717	0.0003926	0.0001214
	4579±0.0	79±0.0028	65±0.0078	54±0.0097		193±0.002	15±0.0012	698±0.000	9293±0.00	694±0.000	353±0.000	7585±0.00	837±0.000	543±0.005	452±0.000	073±0.000	333±0.001	565±0.000	669±0.000	359±0.000
QPP Hybrid 20	00349768	149051	90235	435045	0±0	6988147	870895	3871151	00442062	09025278	6078962	00507517	2970466	7840178	3229067	2085285	501073	7426972	1716898	04748471
	0.004269	0.0057931	0.0278972	0.0430361	0.0001874	0.0093543	0.0049239	0.0023030	0.0002992	0.0013379	0.0033823	0.0001440	0.0019076	0.0333032	0.0032996	0.0011411	0.0074640	0.0062570	0.0013339	0.0001618
	0561±0.0	4±0.00098	33±0.0049	81±0.0113	414±0.000	635±0.002	67±0.0020	685±0.000	667±0.000	67±0.0010	71±0.0005	558±0.000	603±0.001	687±0.011	147±0.002	68±0.0002	906±0.001	388±0.002	8±0.00069	139±0.000
QPP Hybrid 25	00699833	02109	86444	80583	2641226	863602	015564	4049921	141909	49088	977175	1663501	067472	3730244	578605	281071	153801	253185	8569	119189
	0.001688	0.0042970	0.0185201	0.0237715		0.0033776	0.0017557	0.0014256	0.0001063	0.0001698	0.0019808		0.0004548	0.0207593	0.0005275	0.0004295	0.0034245	0.0018163	0.0003982	0.0000978
	0979±0.0	51±0.0006	59±0.0033	48±0.0121		91±0.0020	29±0.0017	385±0.000	339±0.000	036±0.000	56±0.0004		921±0.000	688±0.008	476±0.000	147±0.000	118±0.002	766±0.001	46±0.0000	0602±0.00
QPP Hybrid 28	00271718	235101	25288	309901	0±0	479588	553255	3213544	04304956	06898908	819294	0±0	3536305	3449688	2563255	1246762	788864	34109	9454382	00747207
	0.001578	0.0031190	0.0228559	0.0251230		0.0047721	0.0030079	0.0015691	0.0000640	0.0001278	0.0021699	0.0000242	0.0005911	0.0148574	0.0006148	0.0004987	0.0033889	0.0016209	0.0003803	0.0001575
	6804±0.0	74±0.0011	92±0.0083	42±0.0129		435±0.003	02±0.0017	532±0.000	2349±0.00	75±0.0001	272±0.000	6179±0.00	391±0.000	978±0.005	385±0.000	46±0.0002	995±0.001	766±0.001	437±0.000	181±0.000
QPP Hybrid 38	00485819	731056	87709	98166	0±0	3670578	312362	5538586	00426869	095665	7644188	00485236	4997597	8599485	4543317	962318	750523	019124	2540361	06357525
	0.003149	0.0078645	0.0268852	0.0304050	0.0000248	0.0067119	0.0037956	0.0018990	0.0001101	0.0002207	0.0036252	0.0000253	0.0008606	0.0378674	0.0009561	0.0006847	0.0090652	0.0030706	0.0006703	0.0004283
	2882±0.0	14±0.0051	91±0.0115	05±0.0152	1154±0.00	031±0.006	33±0.0026	164±0.000	307±0.000	845±0.000	118±0.002	3277±0.00	107±0.000	777±0.026	96±0.0011	551±0.000	053±0.006	223±0.002	602±0.000	841±0.000
QPP Hybrid 43	01029297	672403	74059	503882	00496231	3318403	524559	8719656	08499491	2247013	5363583	00506655	7323513	2502169	45673	34193	734026	085509	5682421	3642795

Supplementary Table 9: Free Amino Acid Levels (g/100g) in Oil Popped Flakes. Free amino acid values of all twenty amino acids in oil-popped flakes are recorded. As shown, all free amino acids substantially decline in abundance after popping. The five elite hybrids and two popcorn parents were popped with microwave and oil popping methods. Standard deviations were calculated by four biological replications of each genotype.