Supplemental data for:

Contents

Supplemental Figure 1
The frequency percentage for the four qualitative morphological traits observed in the 15 wheat accessions studied.
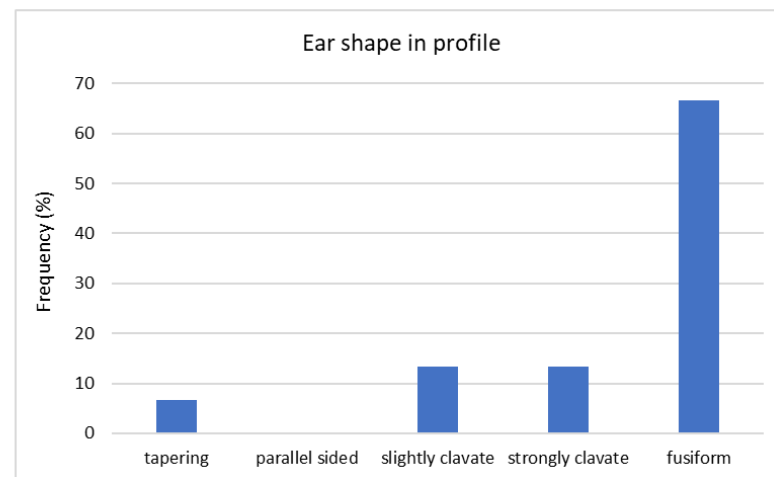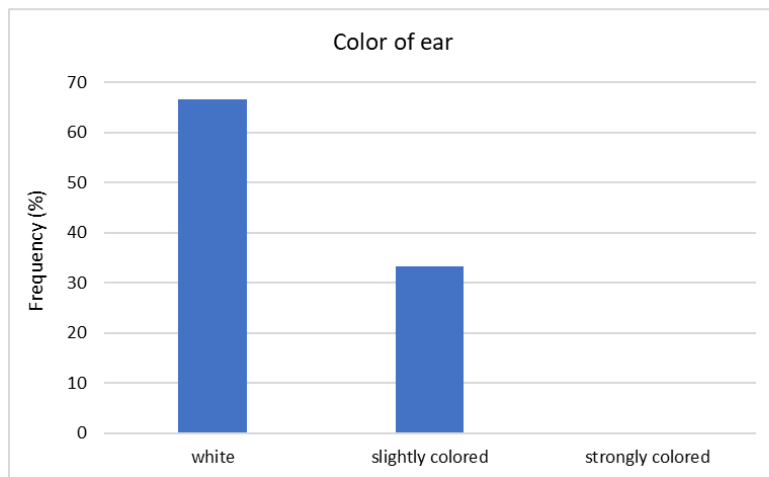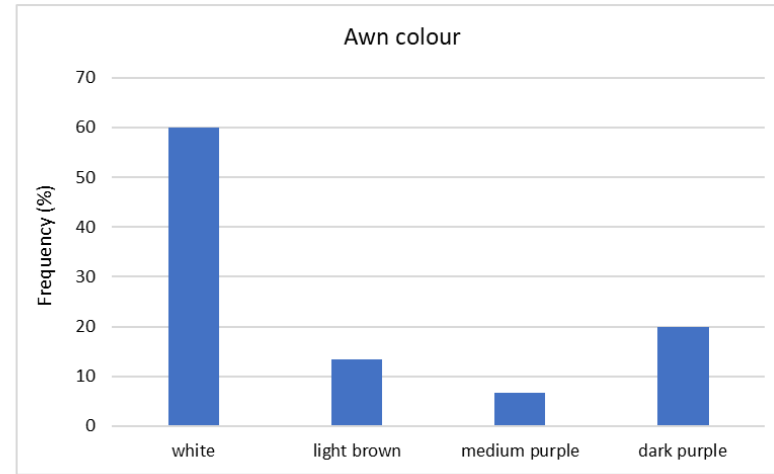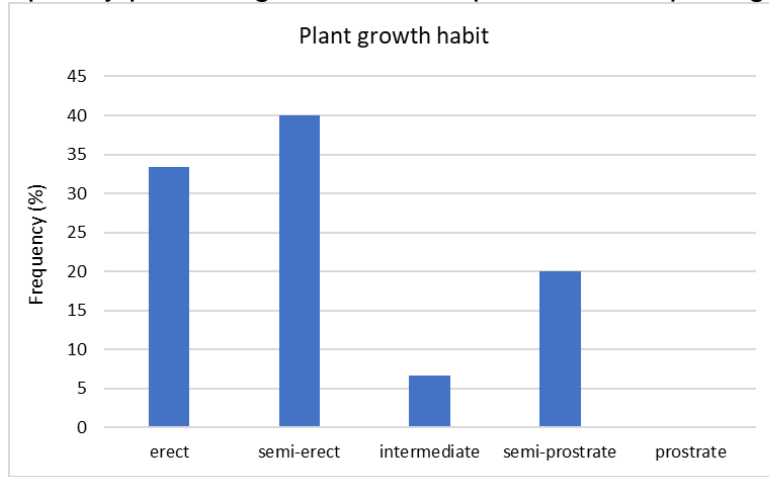
Supplemental Figure 2

R-squared = 70.58 percent

R-squared (adjusted for d.f.) = 68.35 percent

Standard Error of Est. = 0.7451

Mean absolute error = 0.5401
The equation of the fitted model is
TKW (g) = 2.0574 + 0.0326*SF (N)
Since the P-value in the ANOVA table is less than 0.05, there is a statistically significant relationship between TKW (g) and SF (N) at the 95.0% confidence level.
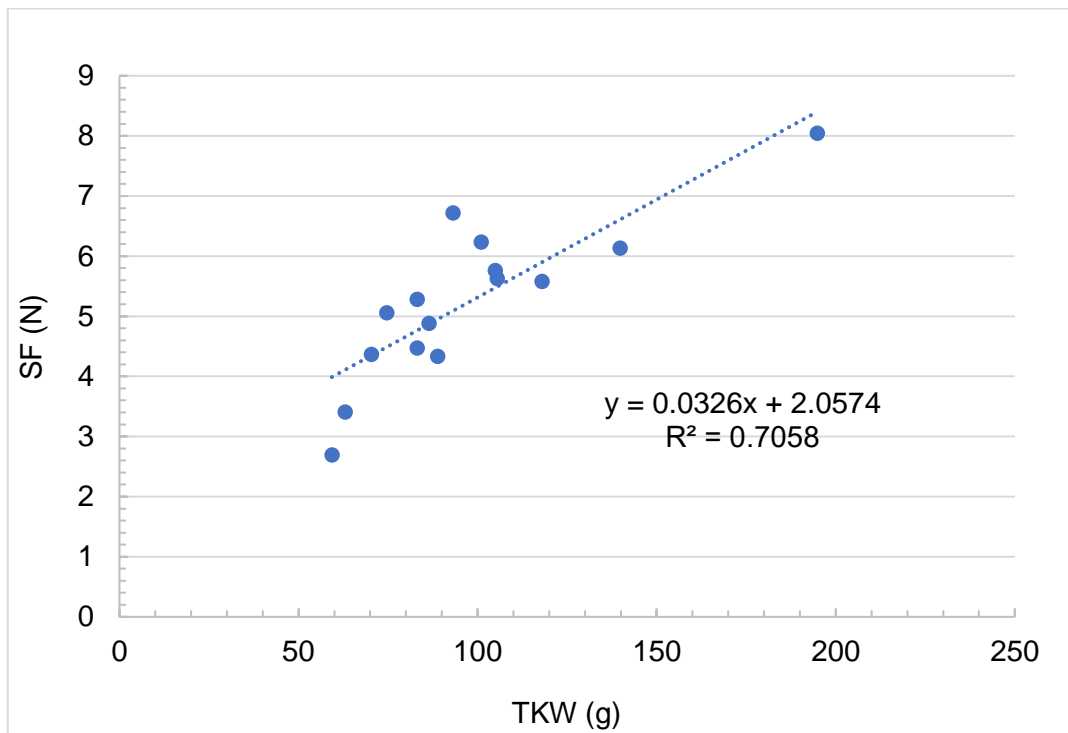
Supplemental Table 1
Summary table of Friedman test results and Medians of qualitative variables;
plant growth habit; colour of ear; ear shape in profile and awn colour, for 15
Triticum spp accessions.

Accession code	Plant growth habit	Colour of ear	Ear shape in profile	Awn color
W1	3,0	2,0	5,0	1,0
W2	1,0	2,0	5,0	2,0
W3	2,0	2,0	1,4	1,0
W4	1,0	1,0	3,0	1,0
W5	8,0	1,0	5,0	1,0
W6	3,0	1,0	5,0	1,0
W7	2,0	1,2	5,0	4,0
W8	7,0	1,0	5,0	1,0
W9	2,0	1,0	5,0	4,0
W10	2,0	1,8	5,0	1,8
W11	3,0	1,0	4,3	1,0
W12	6,0	1,9	3,3	3,3
W13	3,0	1,0	5,0	4,0
W14	4,0	1,4	5,0	1,5
W15	5,0	1,0	5,0	1,0
Friedman				
χ^2	27,6	36,2	34	39,5
P	**0,016**	**< .001**	**0,002**	**< .001**

Where W1=Yekora-T. aestivum, cultivar; W2= Elisavet-T. aestivum, cultivar; W3= Elpida-T. durum, cultivar; W4= Mexicali 81-T. durum, cultivar; W5= Zoulitsa-T. aestivum, landrace; W6= Ntopio-T. aestivum, landrace; W7= Mavragani-T. durum, unknown status from Skyros; W8= Grilos-T. aestivum, landrace; W9= Leventis-T. polonicum, landrace; W10= Kopaida-T. dicoccum Schrank, landrace; W11=Asprositi-T. aestivum, landrace from Kalavrita; W12= Asprositi-T. durum, landrace from Kozani; W13= Mavragani-T. durum, unknown status from Lemnos; W14= Aspratheri-T. durum landrace and W15= Kokkinositaro-T. aestivum, landrace.

Supplemental Table 2
Analysis of Variance for quantitative agromorphological traits (ANOVA tables).
All F-ratios are based on the residual mean square error. Since P-value is less than 0.05, the factor has a statistically significant effect on the variable at the 95.0% confidence level (bold).

Time of ear emergence

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Main effects					
A:variety	3963	14	283,1	78,50	**0,000**
B:block	14,68	2	7,339	2,03	0,150
Residual	101	28	3,607		
Total (corrected)	4079	44			

Total number of tillers

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Main effects					
A:variety	136,9	14	9,781	7,66	**0,000**
B:block	1,758	2	0,879	0,69	0,511
Residual	35,75	28	1,277		
Total (corrected)	174,4	44			

Plant length

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Main effects					
A:variety	30870	14	2205	23,9	**0,000**
B:block	254,9	2	127,5	1,38	0,267
Residual	2580	28	92,13		
Total (corrected)	33710	44			

Ear length excluding awns

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Main effects					
A:variety	185,6	14	13,26	19,4	**0,000**
B:block	1,707	2	0,854	1,25	0,302
Residual	19,12	28	0,683		
Total (corrected)	206,4	44			

Plant weight

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Main effects					
A:variety	10420	14	744	11	**0,000**
B:block	91,66	2	45,8	0,68	0,516
Residual	1894	28	67,7		
Total (corrected)	12400	44			

Number of spikelet (first tiller)

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Main effects					
A:variety	177,9	14	12,7	9,89	**0,000**
B:block	4,485	2	2,24	1,74	0,193
Residual	35,98	28	1,29		
Total (corrected)	218,4	44			

Stem length (base to ear base)

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Main effects					
A:variety	26040	14	1860	46,9	**0,000**
B:block	181,3	2	90,6	2,28	0,121
Residual	1111	28	39,7		
Total (corrected)	27330	44			

Ear length including awns

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Main effects					
A:variety	663,4	14	47,4	5,74	**0,000**
B:block	18,29	2	9,15	1,11	0,344
Residual	231,2	28	8,26		
Total (corrected)	913	44			

Supplemental Table 3

Spearman rank correlations between each pair of variables (qualitative: plant growth habit, colour of ear, ear shape in profile and awn colour versus all the variables).

Variables	Plant growth habit	Ear color	Shape in profile	Awn color
Area	-0,161	-0,423	-0,278	0,313
Aspect	-0,255	0,350	-0,059	0,442
Den./Inten. (mean)	0,244	0,007	0,008	-0,279
Diameter (max)	-0,355	-0,080	-0,057	0,498
Diameter (min)	-0,063	-0,482	-0,113	0,358
Diameter (mean)	-0,138	-0,392	-0,137	0,385
Perimeter	-0,289	-0,132	-0,262	**0,531**
Roundness	0,040	0,153	-0,230	0,292
Size (length)	-0,323	-0,122	-0,036	0,509
Size (width)	0,018	-0,513	-0,121	0,403
Firmness	-0,161	-0,093	-0,282	0,367
Weight	-0,143	-0,200	-0,371	0,367
Volume	-0,170	-0,261	-0,318	0,364
Tap volume	-0,174	-0,261	-0,331	0,364
Bulk density	-0,048	0,102	-0,236	-0,124
Tap density	-0,154	0,267	-0,175	0,113
CI	-0,253	-0,045	0,113	0,324
Time of ear emergence	0,453	-0,434	0,486	0,066
Weight/Plant	**0,525**	-0,337	0,000	0,094
Total number of tillers	**0,623**	-0,004	0,113	-0,139
Number of spikelet in the First	0,126	0,230	0,435	0,407
Plant length	**0,538**	**-0,528**	0,153	-0,074
Ear length excluding awns	-0,247	0,078	-0,367	**-0,701**
Ear length including awns	0,412	-0,380	0,375	0,269
Stem length (base to ear base)	**0,529**	**-0,536**	0,177	-0,119
*L**	0,040	0,334	**-0,572**	-0,143
*a**	0,321	-0,100	0,283	-0,144
*b**	0,027	0,196	-0,393	0,045
WI	0,148	0,202	**-0,596**	-0,237
Plant growth habit		-0,278	0,088	-0,309
Ear colour			-0,042	0,191
Ear shape in profile				0,168

CI: Car Index, L* indicates lightness, a* indicates hue on a green (−) to red (+) axis, b* indicates hue on a blue (−) to yellow (+) axis, and WI: White Index. Values in bold denote significance level at P<0.05.

Supplemental Table 4

Mean values of Image Analysis-Shape factor measurements of 15 Greek wheat accessions. For each trait, different letters following the means indicate significant differences at 95 % level, using Tukey's honestly significant difference (HSD) method

	Area of seed	Aspect (ratio between major and minor axis)	Density/ Intensity. Mean (average optical density)	Diameter max (length of longest line joining two points of outline)	Diameter min (length of shortest line joining two points)	Diameter mean (average length of diameters)	Perimeter (length of the seed outline)	Roundness	Size length (feret diameter along major axis)	Size width (feret diameter along minor axis)
W1, Yekora	17,24 ^{abc}	2,10 ^{cd}	142,68 ^{g}	6,77 ^{b}	3,11 ^{bc}	4,55 ^{bc}	17,56 ^{b}	1,44 ^{a}	6,81 ^{b}	3,30 ^{bc}
W2, Elisavet	13,85 ^{a}	1,89 ^{a}	136,19 ^{def}	5,91 ^{a}	2,97 ^{b}	4,17 ^{a}	15,71 ^{a}	1,43 ^{a}	5,96 ^{a}	3,13 ^{ab}
W3, Elpida	18,24 ^{d}	2,47 ^{cd}	127,41 ^{cdef}	7,94 ^{ef}	3,11 ^{gh}	4,73 ^{cd}	20,58 ^{ghi}	1,92 ^{de}	8,01 ^{f}	3,33 ^{bc}
W4, Mexicali	19,91 ^{abc}	2,07 ^{cd}	133,56 ^{cde}	7,70 ^{e}	3,56 ^{fgh}	5,06 ^{def}	20,11 ^{fgh}	1,63 ^{abc}	7,73 ^{e}	3,79 ^{def}
W5, Zoulitsa	16,21 ^{abc}	2,09 ^{cd}	129,45 ^{bc}	6,75 ^{b}	3,04 ^{b}	4,50 ^{abc}	18,27 ^{bcd}	1,67 ^{abc}	6,82 ^{b}	3,34 ^{bc}
W6, Ntopio	17,48 ^{ab}	1,98 ^{b}	134,35 ^{cdef}	6,81 ^{b}	3,25 ^{cd}	4,61 ^{bc}	18,16 ^{bc}	1,51 ^{abc}	6,85 ^{b}	3,41 ^{bcd}
W7, Mavragani Skyros	21,44 ^{bcd}	2,27 ^{e}	129,69 ^{bc}	8,15 ^{fg}	3,47 ^{efg}	5,17 ^{ef}	21,00 ^{hi}	1,67 ^{abc}	8,20 ^{fg}	3,73 ^{cdef}
W8, Grilos	18,39 ^{abc}	2,08 ^{cd}	130,69 ^{bc}	7,26 ^{cd}	3,34 ^{de}	4,77 ^{cd}	19,30 ^{def}	1,63 ^{abc}	7,30 ^{cd}	3,62 ^{cdef}
W9, Leventis	26,08 ^{cd}	2,37 ^{f}	127,74 ^{ab}	9,26 ^{h}	3,67 ^{h}	5,66 ^{g}	23,62 ^{j}	1,72 ^{bcd}	9,30 ^{h}	3,85 ^{ef}
W10, Kopaida	14,90 ^{e}	2,92 ^{g}	123,95 ^{a}	7,94 ^{ef}	2,53 ^{a}	4,25 ^{ab}	19,64 ^{efg}	2,10 ^{e}	8,04 ^{f}	2,72 ^{a}
W11, Asprositi Kalavrita	17,34 ^{a}	1,86 ^{a}	137,28 ^{ef}	6,55 ^{b}	3,33 ^{de}	4,59 ^{bc}	17,92 ^{bc}	1,48 ^{ab}	6,60 ^{b}	3,49 ^{bcde}
W12, Asprositi Kozani	17,73 ^{abc}	2,10 ^{cd}	138,92 ^{fg}	7,16 ^{c}	3,28 ^{cd}	4,61 ^{bc}	19,34 ^{def}	1,73 ^{bcd}	7,18 ^{c}	3,50 ^{bcde}
W13, Mavragani Lemnos	23,35 ^{abc}	2,14 ^{d}	130,73 ^{bc}	8,31 ^{g}	3,72 ^{h}	5,41 ^{fg}	21,49 ^{i}	1,60 ^{abc}	8,35 ^{g}	3,94 ^{f}
W14, Aspratheri	16,79 ^{abc}	2,07 ^{cd}	131,70 ^{bcd}	7,28 ^{cd}	3,46 ^{efg}	4,83 ^{cde}	18,90 ^{cde}	1,74 ^{cd}	7,32 ^{cd}	3,65 ^{cdef}
W15, Kokkinositaro	19,17 ^{ab}	2,04 ^{bc}	138,77 ^{fg}	7,43 ^{d}	3,39 ^{def}	4,81 ^{cde}	19,25 ^{def}	1,55 ^{abc}	7,47 ^{de}	3,58 ^{cdef}

W1 and W2 T. aestivum, cultivar; W3 and W4 T. durum, cultivar; W5, W6, W8, W11 and W15 = T. aestivum, landrace; W7 and W13= T. durum, unknown status; W9= T. polonicum, landrace; W10= T. dicoccum Schrank, landrace; W12 and W14= T. durum, landrace

Supplemental Table 5

Pearson correlation test between quantitative parameters. Values in red denote P-values below 0.05 indicating statistically significant non-zero correlations at the 95.0% confidence level.

Variables		Area	Aspect	Den./Inten. (mean)	Diameter (max)	Diameter (min)	Diameter (mean)	Perimeter	Roundness	Size (length)	Size (width)	SF	TKW	Volume	Volume tap	Bulk density	Tap density	CI	Time of ear emergence	Plant weight	Total number of tillers	Number of spikelet in first tiller	Plant length	Ear length excluding awns	Ear length including awns	Stem length	L*	a*
Aspect	r	0,086																										
	p	0,761																										
Den./Inten. (mean)	r	-0,217	-0,716																									
	p	0,437	0,003																									
Diameter (max)	r	0,822	0,611	-0,598																								
	p	0,000	0,016	0,019																								
Diameter (min)	r	0,799	-0,437	0,129	0,431																							
	p	0,000	0,103	0,647	0,109																							
Diameter (mean)	r	0,976	0,037	-0,247	0,807	0,864																						
	p	0,000	0,895	0,376	0,000	0,000																						
Perimeter	r	0,878	0,496	-0,555	0,980	0,536	0,863																					
	p	0,000	0,060	0,032	0,000	0,040	0,000																					
Roundness	r	-0,010	0,894	-0,762	0,538	-0,370	-0,001	0,469																				
	p	0,972	0,000	0,001	0,039	0,175	0,998	0,078																				
Size (length)	r	0,812	0,627	-0,612	1,000	0,413	0,796	0,978	0,551																			
	p	0,000	0,013	0,015	0,000	0,126	0,000	0,000	0,033																			
Size (width)	r	0,801	-0,415	0,083	0,445	0,991	0,868	0,557	-0,334	0,427																		
	p	0,000	0,124	0,768	0,097	0,000	0,000	0,031	0,225	0,113																		
SF	r	0,711	0,075	-0,073	0,626	0,593	0,711	0,687	0,127	0,615	0,569																	
	p	0,003	0,791	0,796	0,013	0,020	0,003	0,005	0,651	0,015	0,027																	
TKW	r	0,871	-0,051	-0,120	0,690	0,828	0,887	0,786	0,031	0,677	0,829	0,840																
	p	0,000	0,856	0,671	0,005	0,000	0,000	0,001	0,913	0,006	0,000	0,000																
Volume	r	0,938	0,096	-0,265	0,811	0,785	0,939	0,886	0,119	0,801	0,791	0,791	0,978															
	p	0,000	0,733	0,340	0,000	0,001	0,000	0,000	0,673	0,000	0,000	0,000	0,000															
Volume tap	r	0,936	0,086	-0,244	0,801	0,777	0,931	0,878	0,104	0,790	0,781	0,806	0,982	0,998														
	p	0,000	0,761	0,381	0,000	0,001	0,000	0,000	0,711	0,001	0,001	0,000	0,000	0,000														
Bulk density	r	0,097	-0,720	0,585	-0,275	0,524	0,160	-0,151	-0,508	-0,293	0,496	0,462	0,473	0,283	0,311													
	p	0,731	0,003	0,022	0,321	0,045	0,570	0,592	0,053	0,290	0,060	0,083	0,075	0,308	0,259													
Tap density	r	0,219	-0,641	0,458	-0,128	0,608	0,291	-0,009	-0,431	-0,146	0,579	0,500	0,574	0,401	0,418	0,969												
	p	0,433	0,010	0,086	0,649	0,016	0,293	0,974	0,109	0,604	0,024	0,058	0,025	0,138	0,121	0,000												
CI	r	0,507	0,457	-0,629	0,676	0,277	0,537	0,634	0,418	0,677	0,277	0,223	0,446	0,546	0,496	-0,271	-0,053											
	p	0,054	0,087	0,012	0,006	0,317	0,039	0,011	0,121	0,006	0,319	0,425	0,096	0,035	0,060	0,328	0,851											
Time of ear emergence	r	-0,184	0,225	-0,369	-0,009	-0,334	-0,201	-0,018	0,299	0,001	-0,317	-0,067	-0,266	-0,183	-0,154	-0,408	-0,435	-0,064										
	p	0,512	0,420	0,177	0,976	0,224	0,473	0,949	0,278	0,997	0,249	0,813	0,337	0,514	0,584	0,132	0,105	0,822										
Plant weight	r	0,140	-0,012	-0,013	0,159	0,169	0,143	0,237	0,222	0,151	0,163	0,626	0,390	0,311	0,340	0,408	0,418	-0,001	0,404									
	p	0,618	0,967	0,963	0,571	0,546	0,612	0,396	0,426	0,590	0,563	0,013	0,150	0,260	0,215	0,132	0,121	0,998	0,135									
Total number of tillers	r	-0,451	0,240	-0,090	-0,181	-0,476	-0,458	-0,189	0,406	-0,175	-0,447	-0,099	-0,320	-0,341	-0,314	-0,133	-0,208	-0,296	0,584	0,570								
	p	0,092	0,389	0,751	0,519	0,073	0,086	0,500	0,133	0,534	0,095	0,725	0,244	0,214	0,255	0,637	0,456	0,284	0,022	0,026								
Number of spikelet in the first	r	-0,235	-0,012	0,244	-0,158	-0,179	-0,238	-0,197	0,052	-0,162	-0,240	0,314	-0,077	-0,151	-0,122	0,256	0,229	-0,134	0,256	0,644	0,392							
	p	0,399	0,965	0,382	0,575	0,524	0,392	0,483	0,854	0,564	0,389	0,254	0,785	0,590	0,664	0,357	0,412	0,634	0,358	0,010	0,148							
Plant length	r	0,033	-0,082	-0,055	0,055	0,117	0,059	0,112	0,142	0,052	0,102	0,353	0,212	0,169	0,197	0,231	0,232	-0,034	0,674	0,796	0,608	0,375						
	p	0,907	0,771	0,845	0,846	0,678	0,835	0,692	0,613	0,854	0,716	0,197	0,448	0,548	0,481	0,407	0,406	0,904	0,006	0,000	0,016	0,168						
Ear Length excluding awns	r	-0,219	-0,059	0,199	-0,216	-0,164	-0,211	-0,251	-0,120	-0,214	-0,181	-0,129	-0,092	-0,145	-0,141	0,198	0,153	-0,227	0,409	0,242	0,344	0,207	0,456					
	p	0,433	0,836	0,477	0,440	0,560	0,451	0,367	0,671	0,444	0,519	0,648	0,744	0,605	0,616	0,478	0,587	0,415	0,131	0,385	0,209	0,459	0,088					
Ear Length including awns	r	0,354	0,098	-0,005	0,404	0,300	0,357	0,399	0,160	0,397	0,293	0,422	0,430	0,432	0,437	0,113	0,176	0,260	0,267	0,526	0,267	0,325	0,643	0,042				
	p	0,195	0,729	0,987	0,135	0,277	0,192	0,141	0,568	0,143	0,289	0,117	0,109	0,108	0,103	0,690	0,531	0,349	0,337	0,238	0,337	0,044	0,010	0,883				
Stem length (base to ear base)	r	0,018	-0,092	-0,102	0,030	0,106	0,045	0,094	0,134	0,028	0,093	0,288	0,153	0,123	0,150	0,161	0,157	-0,043	0,710	0,759	0,611	0,330	0,988	0,499	0,523			
	p	0,949	0,745	0,717	0,915	0,708	0,875	0,740	0,634	0,920	0,741	0,594	0,568	0,577	0,594	0,568	0,577	0,880	0,003	0,001	0,016	0,230	0,000	0,058	0,045			
L*	r	0,053	-0,404	0,514	-0,172	0,328	0,073	-0,071	-0,248	-0,183	0,329	0,170	0,337	0,214	0,233	0,649	0,651	-0,215	-0,630	-0,005	-0,285	-0,099	-0,243	0,290	-0,202	-0,266		
	p	0,850	0,136	0,050	0,539	0,233	0,795	0,803	0,373	0,514	0,231	0,545	0,220	0,444	0,403	0,000	0,009	0,442	0,012	0,985	0,303	0,726	0,383	0,294	0,471	0,338		
a*	r	-0,550	-0,344	0,005	-0,564	-0,236	-0,439	-0,593	-0,215	-0,563	-0,247	-0,317	-0,456	-0,516	-0,498	0,100	0,076	-0,174	0,376	0,085	0,211	0,411	0,191	-0,098	-0,108	0,218	-0,353	
	p	0,034	0,209	0,985	0,028	0,397	0,102	0,020	0,441	0,029	0,374	0,249	0,088	0,049	0,059	0,724	0,787	0,535	0,168	0,763	0,450	0,128	0,495	0,728	0,703	0,434	0,198	
WI	r	0,082	-0,301	0,479	-0,114	0,257	0,063	-0,012	-0,180	-0,123	0,266	0,160	0,343	0,240	0,260	0,565	0,565	-0,202	-0,600	-0,009	-0,240	-0,169	-0,233	0,300	-0,159	-0,265	0,974	-0,501
	p	0,771	0,275	0,071	0,687	0,355	0,822	0,968	0,522	0,663	0,338	0,569	0,210	0,389	0,349	0,028	0,028	0,472	0,018	0,974	0,389	0,548	0,403	0,278	0,571	0,340	0,000	0,057

SF: Seed Firmness, TKW: Thousand Kernel Weight, CI: Car Index, L indicates lightness, a* indicates hue on a green (−) to red (+) axis, and WI: White Index. Values in bold denote significance level at P<0.05.*