

Table 3. Analysis of variance for the studied traits related to lodging resistance in bread wheat genotypes in 2017/18 and 2018/19

S.O.V	D.F	Mean squares											
		Plant height		Second internode length		Stem diameter		Dry weight/unit		Lodging in field		Grain yield	
		2017/18	2018/19	2017/18	2018/19	2017/18	2018/19	2017/18	2018/19	2017/18	2018/19	2017/18	2018/19
		M.S	M.S	M.S	M.S	M.S	M.S	M.S	M.S	M.S	M.S	M.S	M.S
Rep	2	2.8	44.71	0.1	0.007	1.61	0.7	0.02	0.06	1.3	0.08	13.438	88.035
Fert	2	7545.9**	11260.96**	132.1**	209.2**	4077.1**	2179.2**	12.7**	13.1**	110.5**	126.8**	2091037.1**	1935738**
Geno	19	120.4**	106.88**	1.9**	0.43**	54.31**	25.1**	0.6**	0.8**	2.7**	2.1**	5385.4**	8653.4**
Fert * Geno	38	22.8**	23.13**	0.5**	0.35**	13.08**	7.5**	0.12**	0.17**	1.04**	1.07**	6579**	3073.2**
Error	118	6	11.5	0.17	0.18	0.3	0.34	0.02	0.03	0.3	0.11	64.4	49.1

*, and **, Significant at 0.05% and 0.01% level of probability, respectively

Table 4. Combined of variance for the studied traits related to lodging resistance in bread wheat genotypes over the two seasons under three levels of nitrogen.

S.O.V	D.F	Mean squares					
		Plant height (cm)	Second internode length (cm)	Stem diameter (mm)	Dry weight/unit (g)	Lodging in field %	Grain yield/m ²
		M.S	M.S	M.S	M.S	M.S	M.S
Year	1	466.9*	7.9**	82.8**	0.06 N.S	0.05 N.S	40928.8**
Rep(Y)	4	23.8	0.1	0.6	0.04	0.67	50.7
Fert(N)	2	18621.6**	333.9**	3323.6**	25.8**	236.9**	3973206.6**
Year*Fert	2	185.3**	7.3**	71.2**	0.002 N.S	0.28 N.S	53568.6**
Geno(G)	19	181.2**	1.3**	31.2**	1.27**	2.49**	7274.9**
Year*Geno	19	46.1**	1.1**	10.1**	0.15**	2.33**	6764.0**
Fert*Geno	38	26.6**	0.4**	6.5**	0.245**	1.11**	5160.7**
Y*N*G	38	19.3**	0.5**	4.9**	0.04 N.S	1.00**	4491.6**
Error	236	8.7	0.17	0.32	0.03	0.18	56.7

*, and **, Significant at 0.05% and 0.01% level of probability, respectively

Table 5. Average plant height (cm) of evaluated wheat genotypes under three nitrogen levels in 2017/18 and 2018/19 and combined over two seasons.

Year	2017/2018				2018/2019				Combined				
Nitrogen(N) Genotype(G)	N ₁	N ₂	N ₃	Mean	N ₁	N ₂	N ₃	Mean	N ₁	N ₂	N ₃	Mean	
Entry 42	86.70	93.30	100.00	93.30	86.70	102.00	113.00	100.60	86.70	97.70	106.50	96.90	
Entry 23	87.30	100.00	110.70	99.30	85.70	101.30	114.00	100.30	86.50	100.70	112.30	99.80	
Entry 25	83.30	94.30	104.30	94.00	85.00	104.30	124.70	104.70	84.20	99.30	114.50	99.30	
Entry 21	84.30	91.70	98.30	91.40	83.70	93.30	113.00	96.70	84.00	92.50	105.70	94.10	
Entry 16	83.30	90.70	99.30	91.10	82.70	90.70	115.00	96.10	83.00	90.70	107.20	93.60	
Entry 19	84.00	94.00	103.70	93.90	83.30	92.70	109.30	95.10	83.70	93.30	106.50	94.50	
Entry 30	83.30	92.00	105.30	93.60	85.70	91.70	113.70	97.00	84.50	91.80	109.50	95.30	
Entry 20	85.70	94.30	110.70	96.90	86.70	93.70	112.00	97.40	86.20	94.00	111.30	97.20	
Entry 13	83.70	90.70	101.00	91.80	82.30	88.30	100.00	90.20	83.00	89.50	100.50	91.00	
Entry 24	84.30	92.30	108.70	95.10	83.70	94.30	110.30	96.10	84.00	93.30	109.50	95.60	
Entry 46	84.30	95.70	113.00	97.70	82.70	93.70	108.70	95.00	83.50	94.70	110.80	96.30	
Shandaweel 1	85.30	94.70	111.70	97.20	84.70	97.30	115.00	99.00	85.00	96.00	113.30	98.10	
Sakha 93	83.00	90.00	105.30	92.80	84.30	93.00	105.00	94.10	83.70	91.50	105.20	93.40	
Giza 171	89.00	98.00	117.00	101.30	88.00	101.00	118.30	102.40	88.50	99.50	117.70	101.90	
Gemmeiza 9	85.00	99.00	117.30	100.40	87.00	100.00	118.30	101.80	86.00	99.50	117.80	101.10	
Sids 13	89.70	99.70	114.70	101.30	87.70	100.30	114.00	100.70	88.70	100.00	114.30	101.00	
Sakha 94	90.30	102.70	117.00	103.30	87.70	101.70	116.00	101.80	89.00	102.20	116.50	102.60	
103 Mohsan	85.70	94.00	104.30	94.70	86.00	98.00	110.70	98.20	85.80	96.00	107.50	96.40	
Sids 1	87.30	96.70	112.30	98.80	89.70	100.70	113.70	101.30	88.50	98.70	113.00	100.10	
Misr 1	86.30	92.70	103.70	94.20	87.70	98.70	111.30	99.20	87.00	95.70	107.50	96.70	
Mean	85.60	94.80	107.90	-	85.50	96.80	112.80	-	85.60	95.80	110.40		
RL.S. D									RL.S. D				
Nitrogen(N)				1.08				1.01	Nitrogen(N)				0.66
Genotype(G)				2.07				2.98	Genotype(G)				1.74
N*G				4.11				7.14	N*G				3.59

Table 6. Average second internode length (cm) of evaluated wheat genotypes under three nitrogen levels in 2017/18 and 2018/19 and combined over two seasons.

Year	2017/2018				2018/2019				combined			
Nitrogen(N) Genotype(G)	N₁	N₂	N₃	Mean	N₁	N₂	N₃	Mean	N₁	N₂	N₃	Mean
Entry 42	4.80	6.61	7.31	6.24	4.23	7.37	8.63	6.74	4.52	6.99	7.97	6.49
Entry 23	4.90	6.71	7.81	6.47	5.43	7.23	8.20	6.96	5.17	6.97	8.01	6.71
Entry 25	4.81	6.27	7.48	6.19	4.48	7.28	8.30	6.69	4.65	6.77	7.89	6.44
Entry 21	5.03	5.72	6.77	5.84	5.23	7.35	8.25	6.94	5.13	6.54	7.51	6.39
Entry 16	5.82	6.67	7.86	6.79	4.57	8.03	9.00	7.20	5.20	7.35	8.43	6.99
Entry 19	4.78	5.81	6.87	5.82	4.67	7.78	8.68	7.04	4.72	6.80	7.78	6.43
Entry 30	5.61	7.51	8.89	7.34	4.53	7.80	8.83	7.06	5.07	7.65	8.86	7.20
Entry 20	4.98	6.26	7.08	6.11	5.20	6.97	7.80	6.66	5.09	6.62	7.44	6.38
Entry 13	5.45	7.08	8.21	6.91	4.34	7.07	8.57	6.66	4.90	7.07	8.39	6.79
Entry 24	5.02	6.79	8.65	6.82	4.77	7.27	7.98	6.67	4.90	7.03	8.32	6.75
Entry 46	4.73	6.70	8.23	6.56	4.50	7.40	8.00	6.63	4.62	7.05	8.12	6.59
Shandaweel 1	4.61	7.73	8.51	6.95	4.67	6.80	7.92	6.46	4.64	7.26	8.21	6.70
Sakha 93	5.11	6.04	7.56	6.24	4.73	7.60	8.17	6.83	4.92	6.82	7.86	6.54
Giza 171	5.33	6.75	8.42	6.83	5.60	7.43	8.24	7.09	5.46	7.09	8.33	6.96
Gemmeiza 9	4.16	5.85	7.93	5.98	5.17	7.43	8.07	6.89	4.66	6.64	8.00	6.43
Sids 13	5.01	7.73	8.47	7.07	5.07	7.40	8.42	6.96	5.04	7.56	8.45	7.02
Sakha 94	4.68	6.82	7.88	6.46	4.47	7.31	8.53	6.77	4.58	7.07	8.21	6.62
103 Mohsan	5.67	6.65	8.67	7.00	4.63	7.77	8.48	6.96	5.15	7.21	8.58	6.98
Sids 1	5.20	7.78	9.00	7.33	4.67	7.83	8.70	7.07	4.94	7.81	8.85	7.20
Misr 1	4.88	7.10	8.10	6.69	4.82	7.92	8.97	7.23	4.85	7.51	8.53	6.96
Mean	5.03	6.73	7.99		4.79	7.45	8.39		4.91	7.09	8.19	
RL.S. D									RL.S. D			
Nitrogen(N)				0.13				0.13	Nitrogen(N)			0.09
Genotype(G)				0.36				0.48	Genotype(G)			0.26
N *G				0.74				0.88	N*G			0.58

Table 7. Average stem diameter (mm) of evaluated wheat genotypes under three nitrogen levels in 2017/18 and 2018/19 and combined over two seasons.

Year	2017/2018				2018/2019				combined				
Nitrogen(N) Genotype(G)	N ₁	N ₂	N ₃	Mean	N ₁	N ₂	N ₃	Mean	N ₁	N ₂	N ₃	Mean	
Entry 42	2.90	3.80	3.30	3.30	2.80	4.00	3.70	3.50	2.80	3.90	3.50	3.40	
Entry 23	3.00	4.00	3.40	3.40	2.90	3.90	3.30	3.30	2.90	3.90	3.30	3.40	
Entry 25	2.90	3.70	3.20	3.30	2.40	3.40	3.00	2.90	2.60	3.60	3.10	3.10	
Entry 21	2.90	3.70	3.40	3.30	2.50	4.00	3.30	3.30	2.70	3.90	3.40	3.30	
Entry 16	2.70	3.50	3.20	3.10	2.50	3.50	3.00	3.00	2.60	3.50	3.10	3.10	
Entry 19	2.90	3.30	3.10	3.10	2.50	3.80	3.00	3.10	2.70	3.50	3.10	3.10	
Entry 30	3.10	4.00	3.60	3.50	2.30	4.00	3.20	3.20	2.70	4.00	3.40	3.30	
Entry 20	2.80	4.00	3.60	3.40	2.40	4.00	3.00	3.10	2.60	4.00	3.30	3.30	
Entry 13	3.00	4.00	3.50	3.50	2.80	4.00	3.50	3.40	2.90	4.00	3.50	3.50	
Entry 24	3.00	4.00	3.50	3.50	2.50	4.10	3.30	3.30	2.70	4.00	3.40	3.40	
Entry 46	3.10	4.00	3.80	3.60	2.80	4.00	3.40	3.40	3.00	4.00	3.60	3.50	
Shandaweel 1	3.00	4.00	3.30	3.40	3.00	4.00	3.40	3.40	3.00	4.00	3.30	3.40	
Sakha 93	3.00	4.00	3.50	3.50	2.80	4.00	3.70	3.50	2.90	4.00	3.60	3.50	
Giza 171	2.90	3.70	3.40	3.30	2.80	4.00	3.40	3.40	2.90	3.80	3.40	3.40	
Gemmeiza 9	3.00	4.00	3.40	3.50	2.80	3.90	3.10	3.30	2.90	4.00	3.30	3.40	
Sids 13	3.00	3.70	3.50	3.40	2.80	3.80	3.10	3.20	2.90	3.70	3.30	3.30	
Sakha 94	2.90	3.50	3.20	3.20	2.70	3.40	3.00	3.00	2.80	3.50	3.10	3.10	
103 Mohsan	2.80	3.80	3.40	3.30	2.70	4.00	3.30	3.30	2.70	3.90	3.40	3.30	
Sids 1	2.80	3.80	3.50	3.30	2.80	3.70	3.30	3.30	2.80	3.80	3.40	3.30	
Misir 1	2.80	3.90	3.20	3.30	2.80	3.90	3.30	3.40	2.80	3.90	3.30	3.30	
Mean	2.90	3.80	3.40		2.70	3.90	3.30		2.80	3.80	3.30		
RL.S. D									RL.S. D				
Nitrogen(N)				0.02				0.02	Nitrogen(N)				0.13
Genotype(G)				0.05				0.05	Genotype(G)				0.32
N * G				0.08				0.09	N * G				0.58

Table 8. Average dry weight per unit length (g) of evaluated wheat genotypes under three nitrogen levels in 2017/18 and 2018/19 and combined over two seasons.

Year	2017/2018				2018/2019				combined			
Nitrogen(N) Genotype(G)	N ₁	N ₂	N ₃	Mean	N ₁	N ₂	N ₃	Mean	N ₁	N ₂	N ₃	M
Entry 42	2.38	3.09	2.66	2.71	2.47	2.92	2.65	2.68	2.43	3.00	2.66	2.69
Entry 23	2.20	3.67	2.69	2.85	2.09	2.96	2.66	2.57	2.14	3.31	2.68	2.71
Entry 25	2.39	3.01	2.70	2.70	2.88	3.88	3.01	3.26	2.63	3.44	2.85	2.98
Entry 21	2.38	3.26	2.58	2.74	2.81	3.68	3.01	3.17	2.59	3.47	2.79	2.95
Entry 16	2.86	3.36	3.12	3.11	2.89	3.42	3.20	3.17	2.87	3.39	3.16	3.14
Entry 19	2.66	2.95	2.89	2.83	2.39	3.15	2.68	2.74	2.52	3.05	2.78	2.79
Entry 30	2.35	3.27	2.76	2.79	2.33	3.19	2.87	2.80	2.34	3.23	2.82	2.79
Entry 20	2.19	2.94	2.62	2.58	2.18	2.94	2.62	2.58	2.18	2.94	2.62	2.58
Entry 13	1.80	2.57	2.21	2.19	1.90	2.57	2.21	2.22	1.85	2.57	2.21	2.21
Entry 24	2.32	3.15	2.82	2.76	2.29	3.15	2.82	2.75	2.30	3.15	2.82	2.76
Entry 46	2.01	3.13	3.00	2.71	1.81	3.13	3.00	2.65	1.91	3.13	3.00	2.68
Shandaweel 1	1.97	3.39	3.09	2.82	1.67	3.39	3.09	2.72	1.82	3.39	3.09	2.77
Sakha 93	2.06	3.53	2.80	2.80	1.96	3.53	2.80	2.76	2.01	3.53	2.80	2.78
Giza 171	2.80	3.64	3.11	3.18	3.00	3.64	3.11	3.25	2.90	3.64	3.11	3.22
Gemmeiza 9	2.58	3.21	2.89	2.89	2.75	3.21	2.89	2.95	2.66	3.21	2.89	2.92
Sids 13	2.81	3.48	3.05	3.12	2.73	3.48	3.05	3.09	2.77	3.48	3.05	3.10
Sakha 94	2.78	3.77	3.01	3.19	2.92	3.77	3.01	3.23	2.85	3.77	3.01	3.21
103 Mohsan	2.32	3.32	2.76	2.80	2.18	3.32	2.76	2.76	2.25	3.32	2.76	2.78
Sids 1	2.70	3.90	3.60	3.40	2.33	3.90	3.60	3.28	2.52	3.90	3.60	3.34
Misr 1	2.44	3.73	3.07	3.08	2.74	3.73	3.07	3.18	2.59	3.73	3.07	3.13
Mean	2.40	3.32	2.87	-	2.42	3.35	2.91		2.41	3.33	2.89	
RL.S. D									RL.S. D			
Nitrogen(N)	0.1				0.06				Nitrogen(N)			
Genotype(G)	0.13				0.15				Genotype(G)			
N*G	0.25				0.29				N*G			

Table 9. Average lodging percentage for evaluated wheat genotypes under three nitrogen levels in 2017/18 and 2018/19 and combined over two seasons.

Year	2017/2018				2018/2019				combined			
Fertilization(N)	N ₁	N ₂	N ₃	Mean	N ₁	N ₂	N ₃	Mean	N ₁	N ₂	N ₃	Mean
Genotype(G)												
Entry 42	0	0	9.33	3.11	0	3.33	9.33	4.22	0	1.67	9.33	3.67
Entry 23	1	4.67	12.67	6.11	1.33	5.33	11.67	6.11	1.17	5.00	12.17	6.11
Entry 25	1.33	4.67	12.33	6.11	1	4.67	11.67	5.78	1.17	4.67	12.00	5.94
Entry 21	0	0.00	4.00	1.33	0	7.00	11.67	6.22	0	3.50	7.83	3.78
Entry 16	0	0.00	4.33	1.44	0	2.67	12.67	5.11	0	1.33	8.50	3.28
Entry 19	0	0.00	10.67	3.56	0	0.00	6.33	2.11	0	0.00	8.50	2.83
Entry 30	0	0.00	7.67	2.56	0	0.00	7.33	2.44	0	0.00	7.50	2.50
Entry 20	1.00	3.00	12.00	5.33	0	0.00	8.67	2.89	0.5	1.50	10.33	4.11
Entry 13	0	7.00	4.67	3.89	0	3.33	3.67	2.33	0	5.17	4.17	3.11
Entry 24	0	3.67	13.33	5.67	0	0.00	6.67	2.22	0	1.83	10.00	3.94
Entry 46	0	5.00	13.33	6.11	0	0.00	7.33	2.44	0	2.50	10.33	4.28
Shandaweel 1	0.67	1.67	8.33	3.56	0	0.00	7.33	2.44	0.33	0.83	7.83	3.00
Sakha 93	0	0.00	4.33	1.44	0	2.33	3.00	1.78	0	1.17	3.67	1.61
Giza 171	0	0.00	13.33	4.44	0	2.67	15.33	6.00	0	1.33	14.33	5.22
Gemmeiza 9	0	5.33	12.33	5.89	0	0.00	11.67	3.89	0	2.67	12.00	4.89
Sids 13	0.67	2.67	8.67	4.00	0	0.00	8.67	2.89	0.33	1.33	8.67	3.44
Sakha 94	1.00	4.33	12.00	5.78	0	4.00	13.33	5.78	0.5	4.17	12.67	5.78
103 Mohsan	0	0.00	4.33	1.44	0	2.00	13.33	5.11	0	1.00	8.83	3.28
Sids 1	0	4.00	8.33	4.11	1	2.67	11.67	5.11	0.5	3.33	10.00	4.61
Misr 1	0	3.33	8.67	4.00	0	4.67	6.67	3.78	0	4.00	7.67	3.89
Mean	0.28	2.47	9.23		0.17	2.23	9.40		0.23	2.35	9.32	
RL.S. D												
Nitrogen(N)	0.16				0.10							0.1
Genotype(G)	0.44				0.28							0.3
N*G	0.84				0.49							0.5

Table 10. Average grain yield/m² (g) of evaluated wheat genotypes under three nitrogen levels in 2017/18 and 2018/19 and combined over two seasons.

Year	2017/2018				2018/2019				combined				
Nitrogen(N) Genotype(G)	N₁	N₂	N₃	Mean	N₁	N₂	N₃	Mean	N₁	N₂	N₃	Mean	
Entry 42	490.40	662.80	882.10	678.40	464.50	747.50	792.50	668.20	477.40	705.10	837.30	673.30	
Entry 23	533.80	715.10	824.20	691.00	559.70	790.70	806.70	719.00	546.70	752.90	815.40	705.00	
Entry 25	455.10	694.10	832.40	660.50	447.00	734.00	827.50	669.50	451.00	714.00	830.00	665.00	
Entry 21	471.40	799.00	903.50	724.60	493.00	742.50	718.30	651.30	482.20	770.70	810.90	687.90	
Entry 16	481.20	665.40	957.50	701.40	426.50	727.00	741.70	631.70	453.90	696.20	849.60	666.50	
Entry 19	479.70	807.50	888.20	725.10	473.30	829.00	861.70	721.30	476.50	818.20	874.90	723.20	
Entry 30	532.30	767.40	837.70	712.40	471.50	730.00	770.20	657.20	501.90	748.70	803.90	684.80	
Entry 20	521.60	706.70	746.40	658.20	452.00	663.00	690.80	601.90	486.80	684.80	718.60	630.10	
Entry 13	479.60	653.30	846.00	659.60	444.80	772.30	803.30	673.50	462.20	712.80	824.70	666.60	
Entry 24	474.60	736.00	855.90	688.80	432.50	725.00	832.00	663.20	453.60	730.50	843.90	676.00	
Entry 46	474.30	779.60	861.90	705.30	475.00	720.30	790.00	661.80	474.70	750.00	826.00	683.50	
Shandaweel 1	437.60	730.90	862.30	676.90	494.00	740.20	794.30	676.20	465.80	735.50	828.30	676.50	
Sakha 93	495.30	695.10	847.10	679.10	458.00	674.50	791.30	641.30	476.70	684.80	819.20	660.20	
Giza 171	487.30	677.00	913.30	692.50	477.80	839.30	856.40	724.50	482.60	758.20	884.80	708.50	
Gemmeiza 9	463.10	659.90	876.30	666.40	454.70	812.50	823.30	696.80	458.90	736.20	849.80	681.60	
Sids 13	469.20	801.00	880.20	716.80	440.00	760.30	779.30	659.90	454.60	780.70	829.70	688.30	
Sakha 94	486.30	749.50	838.90	691.50	463.30	781.20	786.70	677.10	474.80	765.30	812.80	684.30	
103 Mohsan	504.70	826.00	878.80	736.50	488.00	751.00	782.50	673.80	496.40	788.50	830.70	705.20	
Sids 1	560.60	799.10	804.20	721.30	417.70	759.50	774.20	650.40	489.10	779.30	789.20	685.90	
Misir 1	484.20	733.10	781.60	666.30	469.00	802.30	851.70	707.70	476.60	767.70	816.60	687.00	
Mean	489.10	732.90	855.90		465.11	755.10	793.70		477.10	744.00	824.80		
RL.S. D									RL.S. D				
Nitrogen(N)	2.56				2.24				Nitrogen(N)				1.67
Genotype(G)	6.62				5.78				Genotype(G)				4.32
N * G	11.47				10.01				N*G				7.48