

Engineered durum wheat germplasm with multiple alien introgressions: agronomic and quality performance

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Figure S1. Boxplots of the yield-related traits recorded through the seasons 2015 and 2016 [GYM2, grain yield m^{-2} (g); BM2, biomass m^{-2} (g); HI, harvest index; GNM2, grain number m^{-2} ; SNM2, spike number m^{-2} ; PH, plant height (cm); HD, heading date (days); TGW, thousand grain weight (g); GYS, grain yield spike $^{-1}$ (g); GNS, grain number spike $^{-1}$; GNSP, grain number spikelet $^{-1}$; SFI, spike fertility index; SL, spike length (cm); SPN, spikelet number; CHAFF, spike biomass without seeds (g); KAR, cv. Karur; SIM, cv. Simeto]. Boxplots display the quartile range and median (horizontal line) within each of the genotypes analysed.

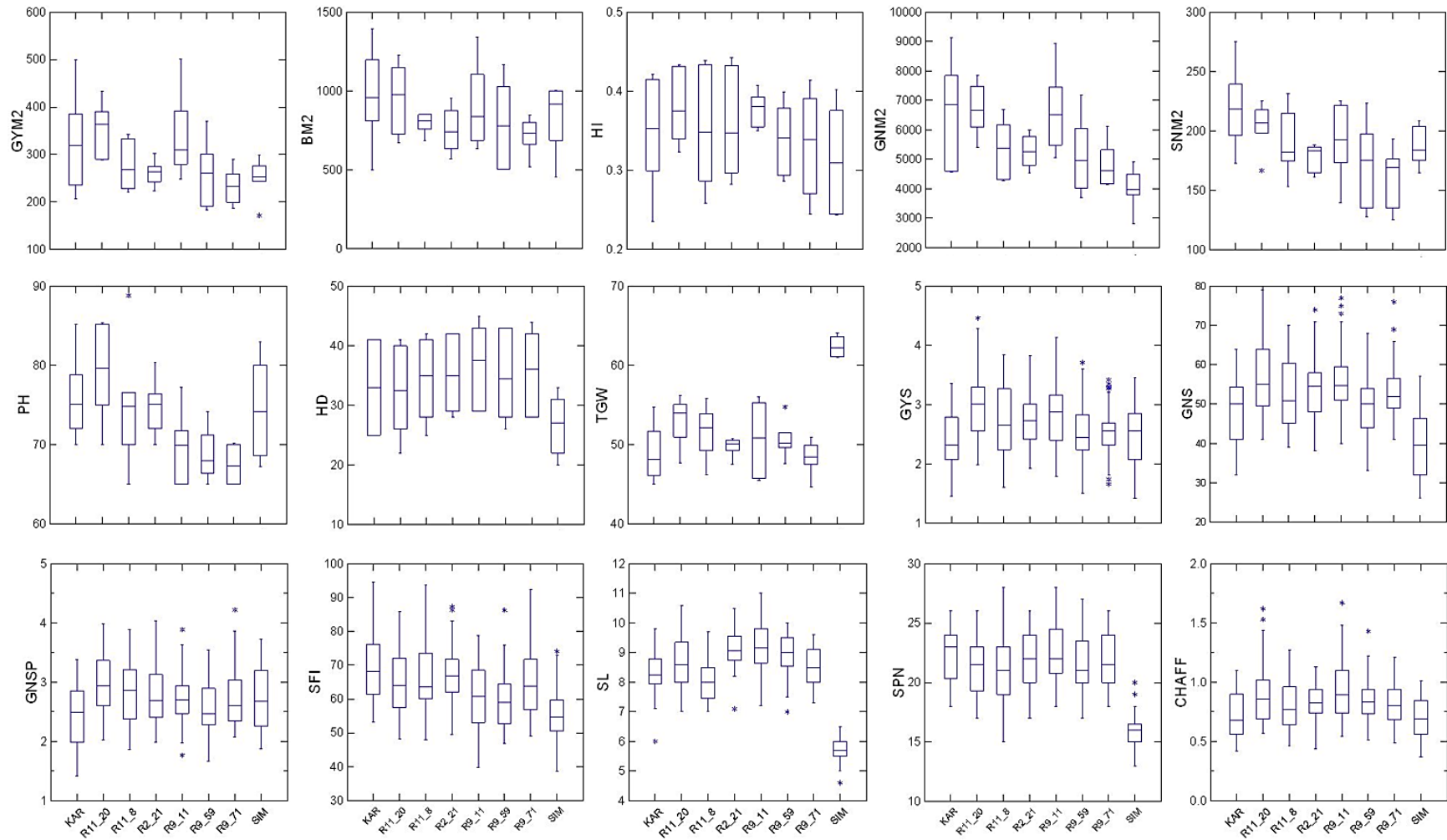


Table S1. Mean values of yield-related traits of the analysed genotypes in each 2015 and 2016 seasons (GYM2, grain yield m⁻²; BM2, biomass m⁻²; HI, harvest index; GNM2, grain number m⁻²; SNM2, spike number m⁻²; PH, plant height; HD, heading date; TGW, thousand grain weight; GYS, grain yield spike⁻¹; GNS, grain number spike⁻¹; GNSP, grain number spikelet⁻¹; SFI, spike fertility index; SL, spike length; SPN, spikelet number; CHAFF, spike chaff). **, and *** indicate significance at $P < 0.01$ and $P < 0.001$ levels, respectively, of the F -value from ANCOVA performed on each independent year dataset Letters in each row correspond to the ranking of the Tukey test at $P < 0.05$ level. The absence of letters indicates non-significance.

2015																	
Genotype	R11-20		R9-11		R9-71		R9-59		R2-21		R11-8		Simeto		Karur		ANCOVA
7el ₁ /1D/3S ^{1a}	+++		+++		+++		++-		++-		+--		---		---		<i>P</i> value
GYM2 (g)	319.8		281.1		249.6		214.2		266.4		323.8		248.9		291.1		0.254
BM2 (g)	759.0		710.8		628.0		559.6		628.8		763.9		659.5		741.4		0.458
HI	0.42		0.40		0.40		0.38		0.42		0.43		0.38		0.39		0.164
GNM2	6328.5		6031.5		5192.9		4334.1		5432.1		6293.8		4070.0		6133.0		0.096
SNM2	195.4		182.4		158.8		147.1		170.6		195.4		181.7		200.7		0.332
PH (cm)	73.3	ab	66.7	c	66.7	c	67.0	c	72.3	abc	70.0	bc	78.3	a	71.3	bc	0.000***
HD (days)	40.0	b	43.3	a	42.7	ab	42.3	ab	41.3	ab	41.3	ab	31.7	c	40.7	ab	0.000***
TGW (g)	50.6	bc	46.8	c	48.1	bc	49.3	bc	49.0	bc	51.4	b	61.1	a	47.1	bc	0.000***
GYS (g)	3.09	a	2.48	b	2.67	b	2.63	b	2.82	ab	2.75	ab	2.86	ab	2.58	b	0.001**
GNS	60.9	a	54.4	ab	56.5	ab	53.0	bc	54.9	ab	54.2	ab	46.5	c	54.4	ab	0.000***
GNSP	3.01	a	2.58	bc	2.76	abc	2.60	bc	2.81	abc	2.92	a	2.88	ab	2.54	c	0.000***
SFI	63.7	ab	58.8	bc	63.6	ab	58.6	bc	67.0	a	60.1	abc	55.1	c	66.6	a	0.000***
SL (cm)	8.6	abc	8.9	ab	8.6	abc	9.0	ab	9.2	a	8.1	c	5.8	d	8.4	bc	0.000***
SPN	19.6	ab	20.6	a	19.9	ab	20.2	a	19.8	ab	18.5	b	15.9	c	20.7	a	0.000***
CHAFF (g)	0.98		0.96		0.87		0.89		0.85		0.90		0.82		0.81		0.092

2016																	
Genotype	R11-20		R9-11		R9-71		R9-59		R2-21		R11-8		Simeto		Karur		ANCOVA
7el ₁ /1D/3S ^{1a)}	+++		+++		+++		++-		++-		+-	---	---	---	---		P value
GYM2 (g)	390.0		398.6		216.8		308.2		256.9		229.5		249.2		364.6		0.016*
BM2 (g)	1149.4	ab	1104.7	ab	801.7	b	1026.4	ab	875.2	ab	822.4	b	1000.7	ab	1197.8	a	0.011*
HI	0.34	ab	0.36	a	0.27	bc	0.30	abc	0.29	abc	0.28	bc	0.25	c	0.30	abc	0.003**
GNM2	7055.4		7294.6		4462.6		5956.2		5106.3		4451.5		3915.5		7157.5		0.014*
SNM2	211.7		199.2		164.2		197.5		185.0		184.2		191.7		239.2		0.089
PH (cm)	84.9	a	72.9	bc	68.3	c	70.6	bc	77.3	abc	80.0	abc	70.7	bc	80.7	ab	0.002**
HD (days)	24.7	bc	30.3	a	28.7	ab	27.3	ab	29.0	ab	27.3	ab	21.7	c	25.3	bc	0.000***
TGW (g)	55.3	b	54.6	b	48.5	b	52.0	b	50.3	b	51.7	b	63.7	a	50.8	b	0.000***
GYS (g)	2.96	ab	3.14	a	2.43	cd	2.46	cd	2.67	bc	2.67	bc	2.08	d	2.20	d	0.000***
GNS	53.4	ab	57.5	a	50.1	b	47.3	bc	53.0	ab	51.1	ab	32.7	d	43.0	c	0.000***
GNSP	2.36	a	2.32	a	2.14	ab	2.01	bc	2.22	ab	2.18	ab	2.06	bc	1.82	c	0.000***
SFI	65.5	bc	62.9	bcd	66.9	abc	61.1	cd	67.0	abc	74.0	a	56.6	d	70.8	ab	0.000***
SL (cm)	8.8	bcd	9.4	a	8.6	cd	8.9	abc	9.2	ab	7.9	e	5.7	f	8.2	de	0.000***
SPN	23.0	b	24.7	a	23.5	ab	23.5	ab	24.0	ab	23.5	ab	15.9	c	23.7	ab	0.000***
CHAFF (g)	0.83	ab	0.93	a	0.77	b	0.79	b	0.80	b	0.71	bc	0.59	d	0.62	cd	0.000***

^{a)} Symbols of alien chromosomes involved in the transfers into A or B genome chromosomes of durum wheat

Table S2. Correlations between four principal components variants and main yield-related traits of the eight genotypes analysed in the 2015 and 2016 seasons. Variable loading scores with the greatest loads on each component are highlighted in bold.

Principal components	PC1	PC2	PC3	PC4
GYM2	0.36	0.47	-0.19	0.23
BM2	0.52	0.17	-0.09	-0.36
SNM2	0.45	0.23	-0.33	0.35
TGW	0.30	-0.12	0.72	0.47
GNS	-0.29	0.57	0.06	-0.28
GYS	-0.11	0.56	0.51	-0.07
HD	-0.46	0.20	-0.26	0.63
Standard deviation	1.78	1.44	1.06	0.64
Variation explained (%)	45.0	29.7	16.1	5.9
Cumulative proportion of total variance	45.0	74.7	90.8	96.7

Table S3. Mean squares from the ANCOVA of yield-related traits in 2017 season (HD, heading date; PH, plant height; GY, grain yield; SNM2, spike number m⁻²; GNM2, grain number m⁻²; TGW, thousand grain weight; TW, hectolitre/test weight; df, degrees of freedom; K-S, Kolmogorov-Smirnov normality test). ** and *** indicate significance at $P<0.01$ and $P<0.001$ level, respectively.

Trait	Factor	Co-variate		Error	K-S (P-value)
	Genotype	Replica			
df	8	1		17	
HD (days)	32.3	***	0.1	0.7	0.036
PH (cm)	79.3	***	0.9	10.6	0.797
GY (t ha ⁻¹)	0.8	**	0.2	0.1	0.557
GNM2	3835098.6	**	375151.8	599692.2	0.763
SNM2	710.6		74.7	323.7	0.403
TGW (g)	111.0	***	0.01	10.0	0.782
TW (g)	13.6	***	0.2	0.2	0.842

Table S4. Pearson's correlation coefficients between pairs of yield-related traits recorded for the four tested genotypes in 2017 season (GY, grain yield ha⁻¹; HD, heading date; SNM2, spike number m⁻²; TGW, thousand grain weight; PH, plant height; GNM2, grain number m⁻²). ** and *** indicate significance at $P<0.01$ and $P<0.001$ level, respectively.

	GY	HD	SNM2	TGW	PH	GNM2
GY	1					
HD	-0.187	1				
SNM2	-0.024	0.362	1			
TGW	0.219	-0.755***	-0.37	1		
PH	0.623**	-0.04	-0.173	-0.008	1	
GNM2	0.702**	0.379	0.236	-0.529	0.523	1