INTERNATIONAL CONFERENCE
FROM SEED TO PASTA IV
A Sustainable Durum Wheat Chain for Food Security and Healthy Lives
BOLOGNA – ITALY, 26-29 October 2022

Performance of locally adapted durum wheat germplasm in the Mediterranean basin and recombinant lines with *Thinopyrum* spp. introgressions across Algerian and Italian environments with different water availability

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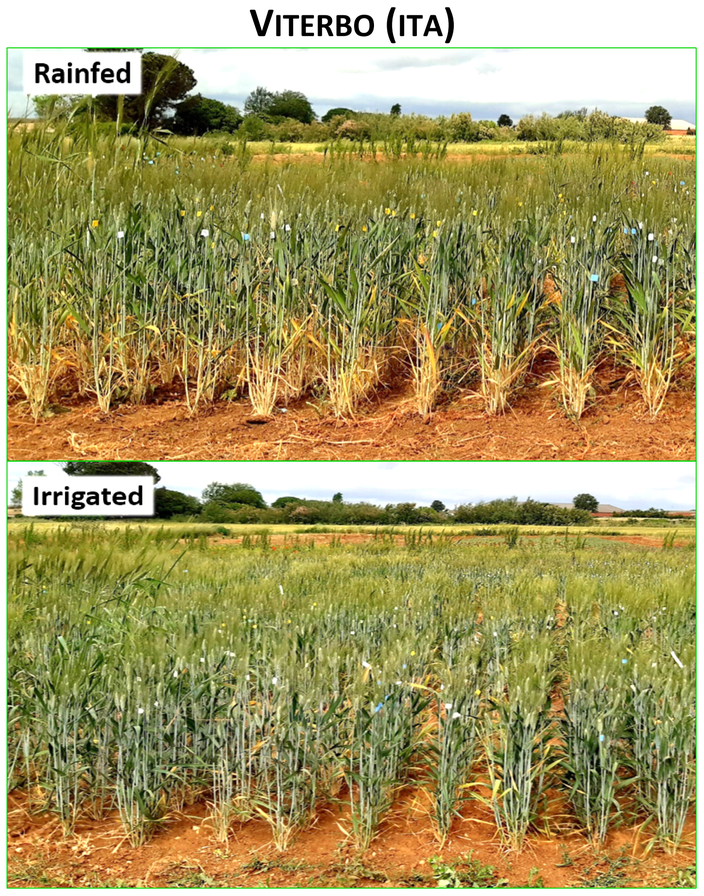
INTRODUCTION - To widen durum wheat (DW) genetic basis and bring about innovations in national breeding programs, partner countries of PRIMA project IMPRESA shared a set of nearly 70 genotypes for testing in diverse and stressful environments. Materials comprised cvs. coming from North Africa (NAF), Italy (ITA) and Turkey (TUR), as well as DW recombinant lines (RLs) with multiple disease resistance and other valuable genes from *Thinopyrum* spp. introgressions. Here, results are given of trials run in 2019-20 in 1 site in Central Italy (Viterbo), and 2 sites in Algeria (Sétif and Biskra).

ENVIRONMENTS

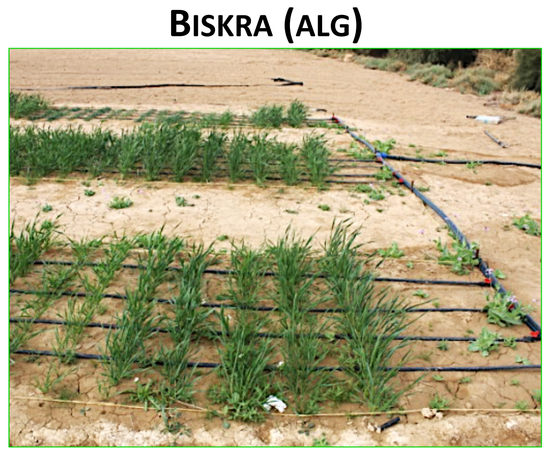
Experim. site	Country	Climate, environment	Altitude (m a.s.l.)	Annual rainfall (mm)
SÉTIF	NE Algeria, Sétif region	Semi-arid; drought + heat; cold winters	1096	349 (169 in 2019-20)
BISKRA	NE Algeria, South of Saharan Atlas	Very arid (desert) and hot; saline soils	87	121 (28 in 2019-20)
VITERBO	Central Italy (Lazio)	Temperate; terminal heat + drought	330	790 (168 in 2019-20)

TRIALS & TRAITS - Trials consisted of randomized triplicated rows (1.2 m-long) with spaced plants (13)/genotype. In Biskra (BIS), irrigation (IRR) throughout the growth cycle was indispensable, which implied further enhancement of inherent soil salinity. Rainfed (RF) and RF + IRR (4 applications in post-anthesis) regimes were adopted in Sétif (SET) and in Viterbo (VT), respectively. Plant yield traits (5 plants/row) and, in VT, photosynthesis-related parameters (flag leaf of 3 plants/row) were assessed and data subjected to ANOVA analysis.

VITERBO (ITA)



BISKRA (ALG)



SÈTIF (ALG)

GENOTYPES PERFORMANCE – PHYSIOLOGICAL TRAITS

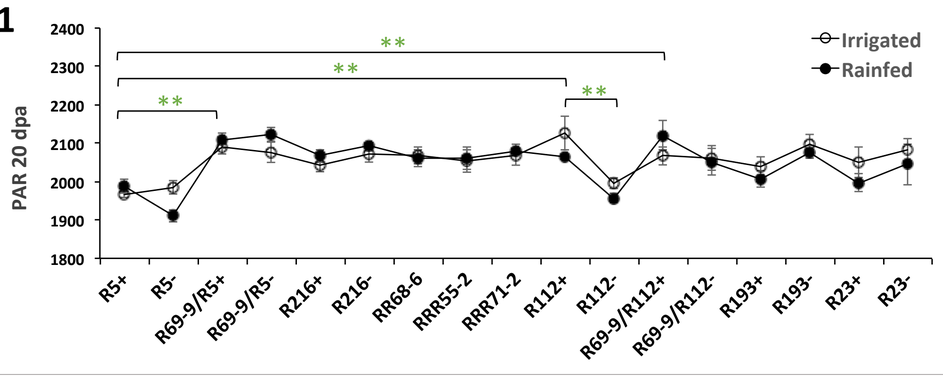
Measured parameters (20 days post-anthesis), correlated with photosynthetic efficiency, included: chlorophyll content (SPAD), quantum yield (QY) and photosynthetic active radiation (PAR). As for SPAD, ANOVA revealed significant genotype (G) x treatment (T = RF vs. IRR) interactions only for Italian cvs. (Dorato, Simeto, Spartaco and Kanakis had higher values under IRR, while Antalis, Rusticano, San Carlo and Saragolla showed good and stable values across T), and for NAF cvs. (Maali, from Tunisia and Margherita, from ICARDA, being the most stable.

ANOVA

	G	T	G x T	df
SPAD20				
ITA	***	***	***	224
NAF	***	***	**	160
TUR	***	***	0.46	302
RLs	***	***	0.08	272
QY20				
ITA	***	***	0.38	224
NAF	***	**	0.49	160
TUR	***	**	0.63	302
RLs	*	***	0.31	272
PAR20				
ITA	***	**	*	152
NAF	***	0.14	0.41	145
TUR	***	0.07	*	208
RLs	***	0.35	0.37	176

Among RLs, R112+, R5+ (with *Thinopyrum ponticum* introgressions) and R69-9/R5 (*Th. ponticum* + *Th. elongatum* "nested" introgression) had the best and most stable SPAD ratings. Alien introgressions also affected PAR values (Fig. 1), with R112+ > R112- (control) and R112+, R69-9/R5+ > R5+ (**).

FIG. 1



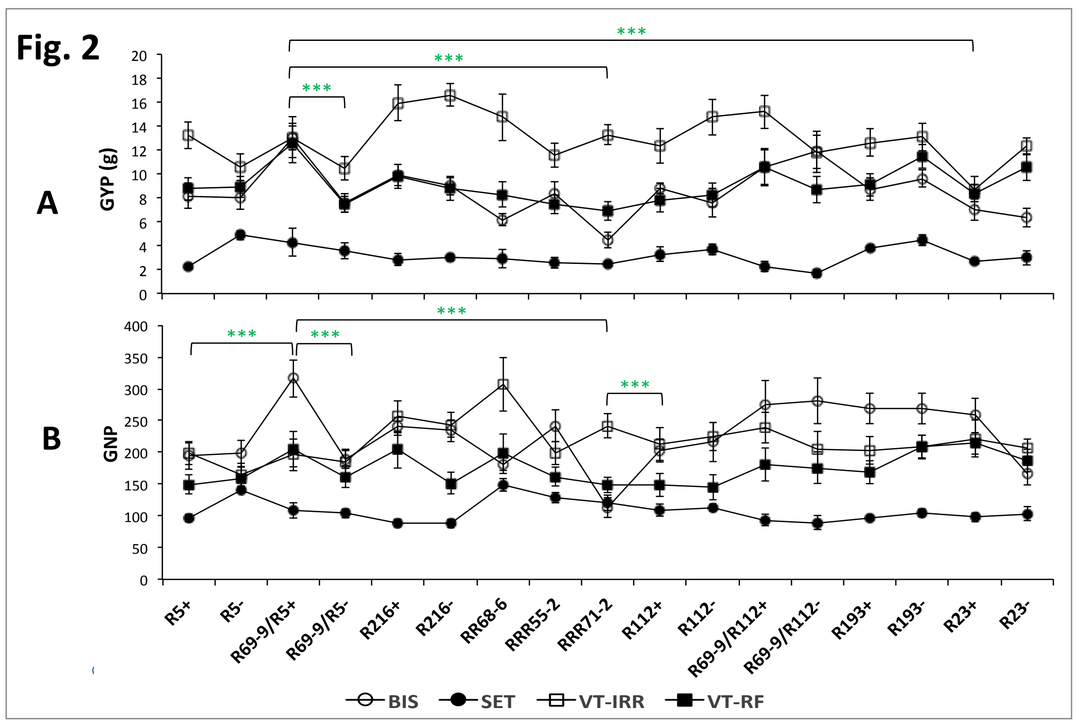
GENOTYPES PERFORMANCE – YIELD TRAITS

Considering grain yield/plant (GYP), the lowest average values were registered in SET (3 g) and the highest in VT-IRR (> 12 g). In the latter, top yielding cvs. were Monastir (ITA), besides Icaverve and Margherita (ICARDA), Karim (Tunisia) and Waha (Algeria) among NAF cvs. These cvs. had a similar good performance in BIS. In SET, best yielders were cvs. Kanakis, Minosse and Saragolla (ITA). However, among groups of genotypes (origin), only RLs showed a significantly different response across environments (G x E, see ANOVA). In particular, R69-9/R5+ (*Thinopyrum ponticum* + *Th. elongatum*), one of the best yielders in all environments, in BIS was superior to its control (-) and to RLs carrying *Th. ponticum* introgressions only (R5, R112, R216, R193, RR, RRR), indicating an enhancing effect of the *Th. elongatum* "nested" segment in this very hot and saline site (Fig. 2A).

ANOVA

	G	E	G x E	df
GYP				
ITA	***	***	0.21	546
NAF	0.06	***	0.30	402
TUR	0.07	***	0.14	761
RLs	***	***	**	696
GNP				
ITA	***	***	*	678
NAF	***	***	0.05	504
TUR	***	***	*	934
RLs	***	***	***	864
TGW				
ITA	***	***	0.24	553
NAF	***	***	0.63	413
TUR	***	***	***	782
RLs	***	***	***	711

Fig. 2



The main contribution to GYP of "nested" RLs, both in BIS and VT-IRR (for the latter, see R69-9/R112+ vs its control in Fig. 2A), was due to grain number (GNP, Fig. 2B), rather than grain weight (TGW), more stable across environments. The highest TGW rates were detected in VT-IRR (best: Karim, Margherita, Secondrue among NAF cvs.; Simeto, S. Carlo, ITA; Devedisi landrace, TUR; R5+, RLs). As for GNP, the highest values were observed in BIS, where top genotypes among cvs. were Achille, Saragolla, Tirex, Monastir (ITA); Karim, Khiar (NAF, Tunisia); Artuklu, Yaren (TUR), and the mentioned R69-9/R5+ among RLs (Fig. 2B). As a whole, promising clues to enhance local DW diversity with novel attributes for abiotic stress resilience have been gained.