

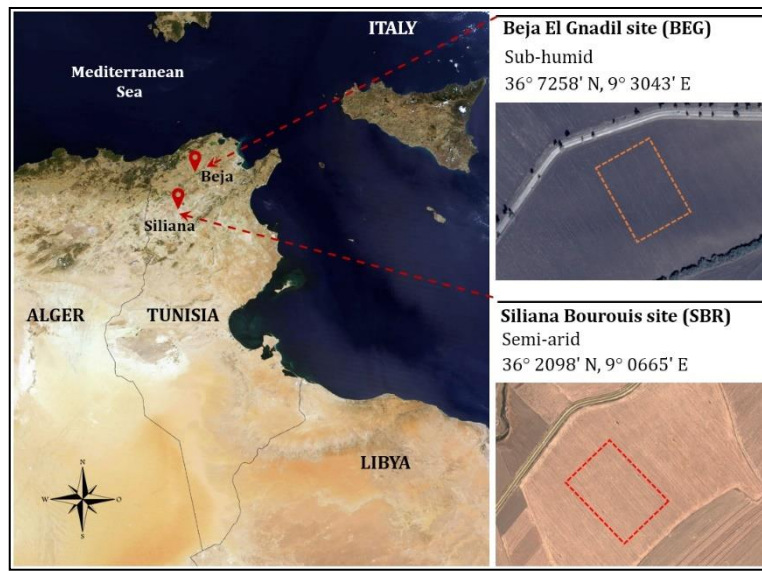


Figure S1. Map of Tunisia showing the experimental sites

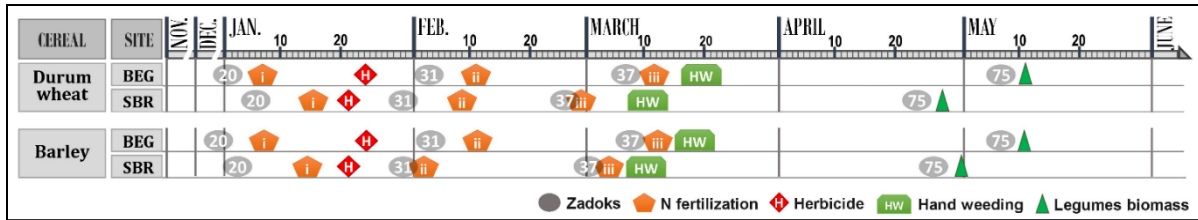


Figure S2. Approximate crop management dates adopted at each site. Grey oval indicates cereal growth stage according to Zadoks; Red diamonds indicate the date of herbicide application; Orange pentagon indicate timing of N-fertilization; Green tiles indicate the date of hand weeding; Green triangles indicate the date of legumes biomass determining.

Table S1. Agronomic characteristics and soil physicochemical properties of both sites.

	BEG	SBR
Site	Beja El Gnadil	Siliana Bourouis
Location (GPS)	36° 7258' N, 9° 3043' E	36° 2098' N, 9° 0665' E
Climate	Sub-humid	Semi-arid inferior
Agro-System	Cereal-legume rotation, with a predominance for cereal crops	
Previous Crop	Oats (<i>Avena sativa</i> L.)	
Soil pH	6.52	7.64
EC (us.cm-1)	175.21	207.02
Sand (%)	11	18
Clay (%)	36	36
Silt (%)	50	43
Organic Matter (%)	1.6–1.8	1.2–1.4
C (%)	1.94	1.48
P2O5 (mg kg⁻¹)	45	41
Kexchangeabe (mg kg⁻¹)	427.6	387.1
K2O (mg kg⁻¹)	481.27	424.14

Soil analysis was performed at 0–40 cm depth.

Table S2. Cereals and legumes plant density after 20 days of sowing date during the three seasons at both sites.

Crops compounds	Season	BEG	SBR
Durum wheat (320)	2016	316 ± 4	311 ± 5
	2017	322 ± 3	305 ± 6
	2018	310 ± 5	299 ± 4
Fenugreek in the IC-Fen pattern (50)	2016	50 ± 2	54 ± 1
	2017	53 ± 1	48 ± 1
	2018	48 ± 2	56 ± 1
Clover in the IC-Clo pattern (50)	2016	99 ± 3	102 ± 3
	2017	105 ± 4	114 ± 6
	2018	98 ± 4	108 ± 5
Fenugreek: Clover in the IC-Mix pattern (50F :100C)	2016	53 ± 1:108 ± 3	54 ± 1:108 ± 3
	2017	51 ± 1:102 ± 3	51 ± 1:93 ± 3
	2018	48 ± 1:107 ± 4	48 ± 1:108 ± 5

Values represent means ± SE plant m⁻². Values in parentheses indicate expected plant density.

Table S3. *p*-value of ANOVA's statistical output showing the influence of season (S), N treatment (NT), cropping pattern (CP), and their interactions, on the different studied parameters, in durum wheat crops at both sites.

		Season (S)	N TreatMent (N)	Cropping Pattern (CP)	S × N	S × CP	N × CP	S × N × CP
	Df	2	4	4	8	8	16	32
BEG	Grain Yield	0.186	0.000 ***	0.000 ***	0.132	0.385	0.004 **	0.995
	Weeds Biomass	0.586	0.200	0.000 ***	0.798	0.788	0.749	1.000
	TKW	0.104	0.000 ***	0.000 ***	0.276	0.453	0.084 °	1.000
	GPC	0.054 °	0.000 ***	0.000 ***	0.196	0.725	0.035 *	1.000
	Grain Ash Content	0.094 °	0.000 ***	0.000 ***	0.711	0.644	0.033 *	1.000
	Straw Yield	0.114	0.000 ***	0.000 ***	0.792	0.773	0.459	1.000
SBR	Grain Yield	0.124	0.000 ***	0.000 ***	0.431	0.475	0.068 °	1.000
	Weeds Biomass	0.070 °	0.587	0.000 ***	0.798	0.081°	0.799	0.999
	TKW	0.415	0.016 *	0.000 ***	0.788	0.159	0.231	1.000
	GPC	0.038 *	0.000 ***	0.000 ***	0.072 °	0.222	0.178	0.991
	Grain Ash Content	0.098 °	0.000 ***	0.000 ***	0.146	0.128	0.067 °	1.000
	Straw Yield	0.081 °	0.000 ***	0.000 ***	0.773	0.793	0.514	1.000

Note: °, *, ** and ***: $p \leq 0.1$, 0.05, 0.01 and 0.001, respectively.

Table S4. P-value of ANOVA's statistical output showing the influence of N treatment (NT), cropping pattern (CP), and their interaction on durum wheat, fenugreek and clover net photosynthetic rate (P_n , $\mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$) at crops flowering stage in 2016 and 2017 seasons at both sites.

Crops	Source of Variation	df	BEG		SBR	
			2016	2017	2016	2017
Durum wheat	Nitrogen Treatment (NT)	4	0.000 ***	0.000 ***	0.000 ***	0.000 ***
	Cropping pattern (CP)	4	0.000 ***	0.000 ***	0.000 ***	0.000 ***
	NT $\times$ CP	16	0.000 ***	0.000 ***	0.096 °	0.205
Fenugreek	NT	4	0.000 ***	0.000 ***	0.006 **	0.013 *
	CP	1	0.124	0.632	0.362	0.641
	NT $\times$ CP	4	0.478	0.558	0.945	0.960
Clover	NT	4	0.000 ***	0.000 ***	0.002 **	0.004 **
	CP	1	0.053 °	0.005 **	0.003 **	0.010*
	NT $\times$ CP	4	0.008 **	0.000 ***	0.084 °	0.110

Note: °, *, ** and ***: $p \leq 0.1$, 0.05, 0.01 and 0.001, respectively.