

Supplementary materials

Materials and Methods

Table S1 presents more detailed information about the agronomic activities performed for all crops used in the experiment. Irrigation was applied based on known water requirements and soil moisture conditions. The water requirements for each plant were calculated using CROPWAT-version 8.0 software, which is based on crop coefficients and reference evapotranspiration.

TABLE S1. Cultivar, plant density, planting and harvesting date for different crops used in the experiment.

Plant	Cultivar	Plant density [plant m ⁻²]	Planting date	Harvest date
Wheat	Chamran 2	400	10 Dec	26 May
Mung bean	CN-9-3	40	5 July	mid-Oct
Sesame	Darab 14	20	5 July	mid-Oct
Maize	S.C.704	8	10 July	mid-Nov

TABLE S2. Contents of carbon and nitrogen, C/N ratio, pH, EC, and moisture contents of air-dried compost, vermicompost, and crop litters used in the experiment.

Manure	Carbon (%)	Nitrogen (%)	C/N	pH	EC (dS/m)	Moisture (%)
Compost	58	1.84	31.5	7.35	3.1	15
Vermicompost	65	2.18	29.8	6.98	5.38	10
Crop residues						
Wheat	48.5	0.684	70.9	-	-	0
Maize	49.5	0.663	74.6	-	-	2
Sesame	47.5	2.8	16.96	-	-	5
Mung bean	48.5	3.3	14.7	-	-	5

Results

TABLE S3. Factor of increase in wheat yield from the first experimental year (2019) to the second year (2020) under four cropping systems (F-W: fallow-wheat; M-W: corn-wheat; S-W: sesame-wheat, and B-W: mung bean-wheat), and three farming management (intensive, IF; organic, OF; and integrated, INT).

Farming management	Cropping system	Improvement factor of grain yield
IF	F-W	1.13
	C-W	1.14
	S-W	1.04
	B-W	1.12
OF	F-W	1.07
	C-W	1.09
	S-W	1.21
	B-W	1.16
INT	F-W	1.11
	C-W	1.22
	S-W	1.41
	B-W	1.22

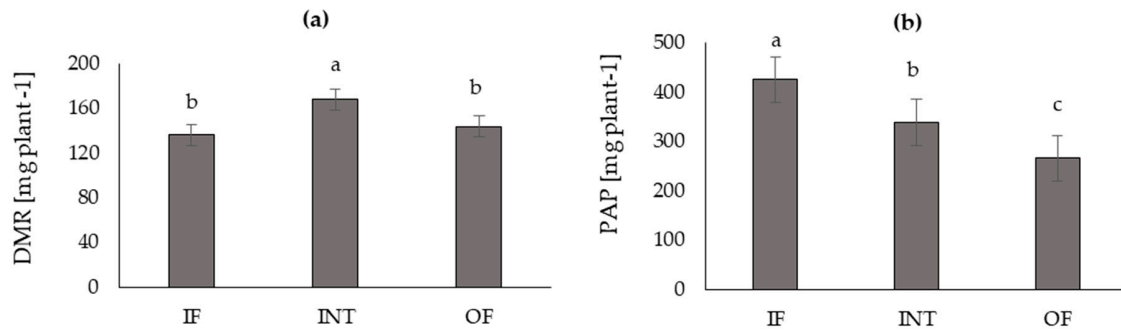


FIGURE S1 Effects of three farm management practices (intensive, IF; organic, OF; and integrated, INT) on a) DMR (dry matter remobilisation), and b) PAP (post-anthesis dry matter photosynthesis). Different letters above each bar indicate a significant difference at $p \leq 0.05$ and $p \leq 0.01$, as determined by Duncan's test.

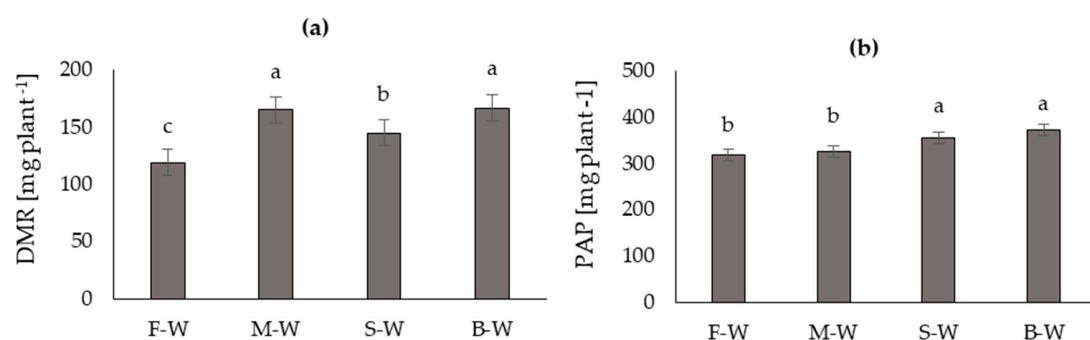


FIGURE S2 Effects of four cropping systems (F-W: fallow-wheat; M-W: maize-wheat; S-W: sesame-wheat, and B-W: mung bean-wheat) on a) DMR (dry matter remobilisation), and b) PAP (post-anthesis dry matter photosynthesis). Different letters above each bar indicate a significant difference at $p \leq 0.05$ and $p \leq 0.01$, as determined by Duncan's test.

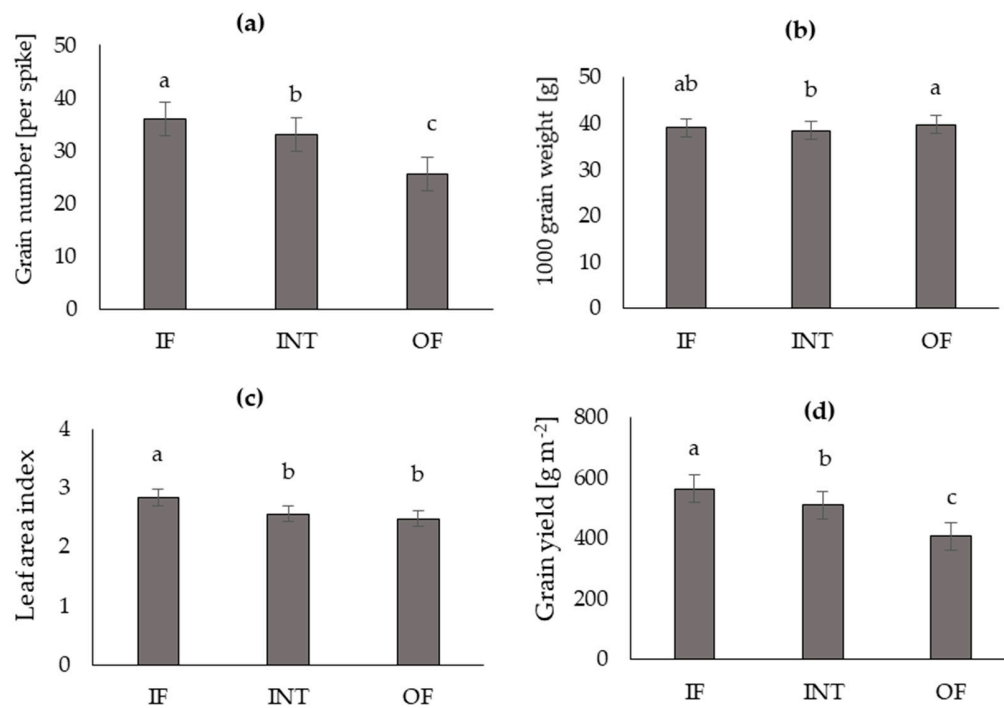


FIGURE S3 Effects of three farm management practices (intensive, IF; organic, OF; and integrated, INT) on (a) grain number per spike, (b) 1000 grain weight, (c) leaf area index, and (d) grain yield. Different letters above each bar indicate a significant difference at $p \leq 0.05$ and $p \leq 0.01$, as determined by Duncan's test.

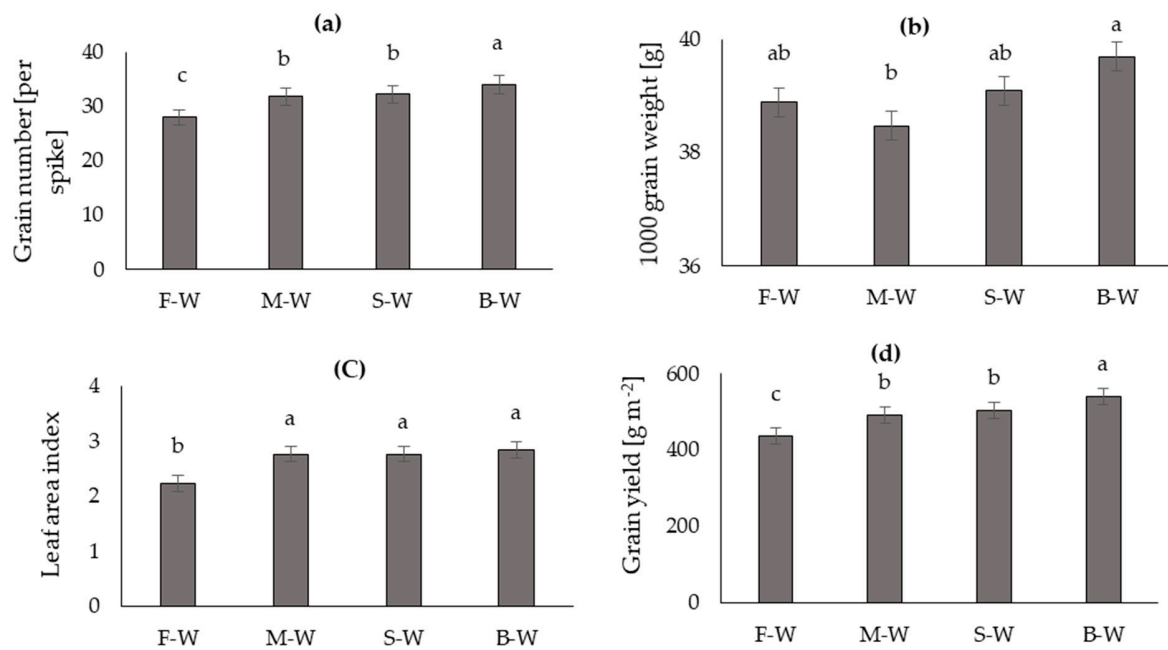


FIGURE S4 Effects of four cropping systems (F-W: fallow-wheat; M-W: maize-wheat; S-W: sesame-wheat, and B-W: mung bean-wheat) on (a) grain number per spike, (b) 1000-grain weight, (c) leaf area index, and (d) grain yield. Different letters above each bar indicate a significant difference at $p \leq 0.05$ and $p \leq 0.01$, as determined by Duncan's test.

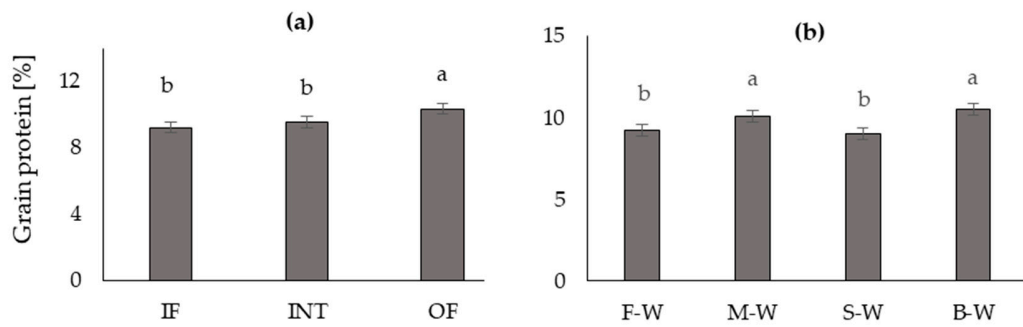


FIGURE S5 Effects of (a) three farm management practices (intensive, IF; organic, OF; and integrated, INT) and (b) four cropping systems (F-W: fallow-wheat; M-W: maize-wheat; S-W: sesame-wheat, and B-W: mung bean-wheat) on grain protein changes. Different letters above each bar indicate a significant difference at $p \leq 0.05$ and $p \leq 0.01$, as determined by Duncan's test.

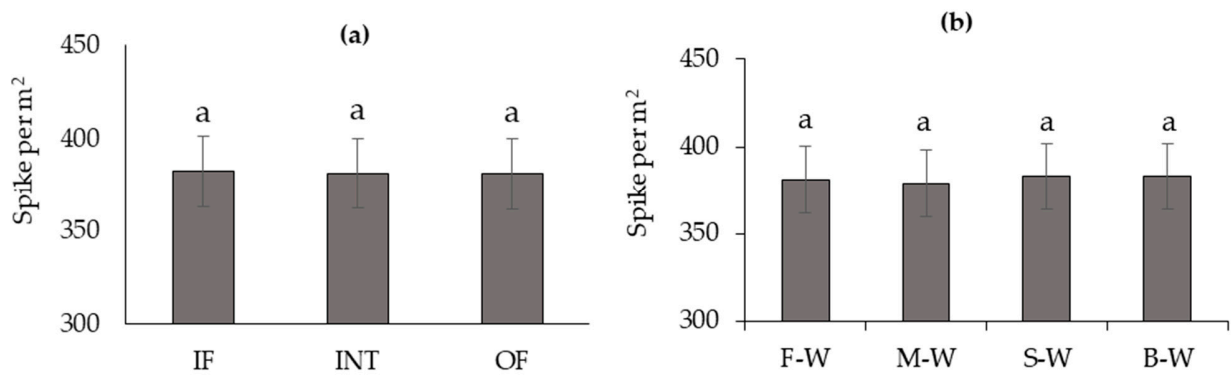


FIGURE S6 Effects of (a) three farm management practices (intensive, IF; organic, OF; and integrated, INT) and (b) four cropping systems (F-W: fallow-wheat; M-W: maize-wheat; S-W: sesame-wheat, and B-W: mung bean-wheat) on the number of spikes per square metre. Different letters above each bar indicate a significant difference at $p \leq 0.05$ and $p \leq 0.01$, as determined by Duncan's test.