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Original article

Evaluation of dry matter remobilization, yield and yield components of three rainfed wheat cultivars affected by supplementa1 irrigation and nitrogen fertilization

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Extended abstract

Introduction

Wheat (*Triticum aestivum* L.) is one of the most important grain products in the world which is the main food of the people in many parts of the world and provides about 20% of the calories needed by the world population. The late stages of wheat growth in the Mediterranean regions are usually accompanied by drought stress. Supplemental irrigation is one of the appropriate strategies to reduce the damaging effects of drought stress and improve yield and sustainability. Nitrogen is the most important nutrient in rainfed farming after wheat planting is the most important tool available to increase yield. Nitrogen fertilizer application to soil at late vegetative stage may not be appropriate due to dry soil surface and reduced root activity, Therefore Nitrogen spraying can be used as a quick and efficient way to meet plant nutrition due to its advantages such as faster and more uptake by the plant.

Matherial and method

In order to study the effect of supplemental irrigation and different rates of urea fertilizer and urea foliar application on dry matter remobilization, yield and yield components and Grain protein contents experimental wheat in split –split plot in randomized complete block design with three replications It was designed and implemented in the research farm of Kurdistan University in 2016-2017. Treatments included irrigation levels (no irrigation and irrigation at booting stage) as main factor, three dry wheat cultivars (Rejaw, Sardari and Azar 2) as sub factor of different rates of nitrogen fertilizer (50 kg urea in fall (A), A + 50 kg urea in the spring (B) and B + foliar solution (20 kg urea in the booting stage) were used as a sub-factor. The studied traits included leaf dry matter, stem + leaf pod and spike in flowering and ripening stages, leaf dry matter remobilization, stem + leaf pod and panicle seed, total soil remobilized dry matter, soil yield. Dry leaf remobilization, stem + leaf pod and pod straw, total remobilization efficiency, remobilization share in grain yield, spike number per square meter, spike number per grain, 1000-grain weight, biological yield, yield, harvest index and grain protein content.

Leaf dry matter, stem + Sheath dry matter and spike dry matter in flowering and maturity stages, leaf dry matter remobilization, stem + Sheath dry matter, Chaff dry matter, total dry matter remobilized, leaf,, stem + sheath, chaff and total dry matter remobilization efficiency, remobilization share in grain

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yield, spike number per square meter, kernals per spike, 1000-grain weight, biological yield, yield, harvest index and grain protein content were measured.

Results

Results showed that the amount of stem + sheath, dry matter at flowering and maturity, leaf, stem + sheath, spike remobilization dry matter, total remobilization, stem+ sheath remobilization efficiency, remobilization share in grain yield, weight Spike, kernals per spike, 1000-grain weight, yield and biological yield were affected by supplemental irrigation.

Among cultivars in terms of stem + sheath and chaff dry matter at flowering and maturity, leaf, stem + Sheath, spike remobilized dry matter, total remobilization, leaf remobilization efficiency, remobilization share in grain yield, weight Spike, kernals per spike, 1000-grain weight, yield, biological yield, harvest index and grain protein were different. Rejaw cultivar had more grain number per spike and yield than Azar2 and Sardari.

Different rates of nitrogen fertilizer had a significant effect on stem + sheath, spike and total dry matter remobilization efficiency and remobilization share on grain yield. Supplemental irrigation at the booting stage increased dry matter stored in stem + sheath and increased the amount of remobilized dry matter during grain filling. Irrigation at booting stage increased grain yield by 12.4%. Increasing urea fertilizer and urea foliar application at the end of growth stages increased plant yield and grain quality by providing more nitrogen and stay-green.

Keywords**:** Anthesis, Booting, Efficiency, Grain protein

Table 1. Effect of supplemental irrigation time, nitrogen and cultivar on studied traits

	P Value						
Traits	**I**	**C**	**I×C**	**N**	**N×I**	**N×C**	**I×C×N**
Flowering							
Leaf dry matter	ns	ns	ns	**	ns	ns	ns
SSDM	**	**	ns	**	ns	ns	ns
Chaff DM	ns	**	ns	*	ns	ns	ns
Maturity							
LDM	ns	ns	ns	ns	ns	Ns	ns
SSDM	**	**	ns	**	ns	Ns	ns
CDM	ns	**	ns	**	ns	Ns	ns
LDMR	*	*	ns	ns	ns	Ns	ns
SSDMR	**	**	ns	ns	ns	ns	ns
SDMR	**	**	ns	ns	ns	ns	ns
TDMR	*	**	ns	ns	ns	ns	ns
LDMRE	ns	*	ns	ns	ns	ns	ns
SSDMRE	**	ns	ns	**	ns	ns	ns
SDMRE	ns	ns	ns	**	ns	ns	ns
TDMRE	ns	ns	ns	**	ns	ns	ns
Remobilization contribution	*	*	ns	**	ns	ns	ns
Spike per m^2	ns	ns	ns	**	ns	ns	ns
Spike weight	*	**	ns	**	ns	ns	ns
Kernels per m^2	**	**	ns	**	ns	ns	ns
1000 grain weight	*	**	ns	**	ns	ns	ns
Yield	*	**	ns	**	ns	ns	ns
Biological yield	*	ns	ns	**	ns	ns	ns
Harvest index	ns	**	ns	**	ns	ns	ns
Grain protein	ns	**	ns	*	ns	ns	ns

ns, * and **: Not significant, significant at %5 and %1 probability levels, respectively.
I= Irrigation, C= Cultivar, N= Nitrogen, LDM= Leaf Dry Matter, SSDM= Stem + Sheath Dry Matter, CDM= Chaff Dry Matter, LDMR= Leaf Dry Matter Remobilization, SSDMR= Stem + Sheath Dry Matter Remobilization, SDMR= Spike Dry Matter Remobilization, TDMR= Total Dry Matter Remobilization, LDMRE= Leaf Dry Matter Remobilization Efficiency, SSDMRE= Stem + Sheath Dry Matter Remobilization Efficiency, SDMRE= Spike Dry Matter Remobilization Efficiency, TDMRE= Total Dry Matter Remobilization Efficiency

Table 2. Effect of supplemental irrigation, cultivar and nitrogen on leaf, stem + sheath and chaff dry matter at anthesis and maturity.

Treatments	**Dry matter at anthesis (g.stem^{-2})**			**Dry matter at anthesis (g.stem^{-2})**		
	Leaf	**Stem +Sheath**	**Chaff**	**Leaf**	**Stem +Sheath**	**Chaff**
Irrigation levels						
Rain fed	0.24^{a}	0.99^{b}	0.36^{a}	0.15^{a}	0.61^{b}	0.29^{a}
Irrigation	0.25^{a}	1.10^{a}	0.38^{a}	0.15^{a}	0.69^{a}	0.31^{a}
Cultivar						
Rejaw	0.24^{a}	1.08^{a}	0.40^{a}	0.15^{a}	0.68^{a}	0.32^{a}
Sardari	0.24^{a}	0.96^{b}	0.37^{b}	0.14^{a}	0.60^{b}	0.26^{b}
Azar2	0.26^{a}	1.09^{a}	0.33^{c}	0.15^{a}	0.67^{a}	0.30^{a}
Nitrogen levels						
N_1	0.23^{a}	0.97^{b}	0.34^{b}	0.14^{a}	0.58^{b}	0.27^{b}
N_2	0.26^{a}	1.07^{a}	0.38^{a}	0.15^{a}	0.68^{a}	0.30^{a}
N_3	0.26^{a}	1.09^{a}	0.38^{a}	0.15^{a}	0.69^{a}	0.31^{a}

Within each column (between two horizontal lines), mean followed by a different letter are significantly different at 5% level (Duncan). N1= 50 kg urea in the fall, N2= 50 kg urea in the fall + 50 kg urea in the spring, N3=100kg urea + 20 kg urea spray

Table 3. Effect of supplemental irrigation, cultivar and nitrogen on Traits associated with dry matter remobilization.

	Dry Matter Remobilization (mg)				Dry matter remobilization efficiency (%)				
Treatments	leaf	Stem +Sheath	spike	total	leaf	Stem +Sheath	spike	total	Remobilization contribution
Irrigation levels									
Rain fed	95.4^{a}	377.1^{b}	70.5^{b}	543.0^{b}	39.08^{a}	38.20^{a}	19.50^{a}	34.20^{a}	77.53^{a}
1 Irrigation	100.0^{a}	406.7^{a}	76.1^{s}	582.7^{a}	39.19^{a}	37.02^{b}	20.32^{a}	33.77^{a}	66.28^{b}
Cultivar									
Rejaw	89.4^{b}	399.2^{a}	87.4^{a}	576.0^{a}	36.55^{b}	37.04^{a}	21.58^{a}	33.43^{a}	71.72^{a}
Sardari	96.9^{ab}	354.6^{b}	61.9^{b}	513.4^{b}	40.02^{ab}	37.13^{a}	19.08^{a}	33.73^{a}	71.12^{a}
Azar2	106.8^{a}	421.8^{a}	70.6^{b}	599.2^{a}	40.83^{a}	38.64^{a}	19.07^{a}	34.77^{a}	72.87^{a}
Nitrogen levels									
N_1	87.0^{a}	385.8^{a}	75.0^{a}	547.8^{a}	37.21^{a}	39.81^{a}	21.66^{a}	35.51^{a}	78.95^{a}
N_2	104.5^{a}	396.2^{a}	76.0^{a}	576.7^{a}	40.82^{a}	36.97^{b}	20.13^{b}	33.87^{b}	72.59^{a}
N_3	101.6^{a}	393.6^{a}	68.9^{a}	564.1^{a}	39.36^{a}	36.04^{b}	17.95^{b}	32.57^{b}	64.17^{b}

Within each column (between two horizontal lines), mean followed by a different letter are significantly different at 5% level (Duncan). N1= 50 kg urea in the fall, N2= 50 kg urea in the fall + 50 kg urea in the spring, N3=100kg urea + 20 kg urea spray

Table 4. Effect of supplemental irrigation, cultivar and nitrogen yield, yield component and Grain protein

Treatments	Spikes per m^2	spike weight (g)	Kernels per spike	1000 grain weight (g)
Irrigation Levels				
Rain fed	462.1[a]	1.01[b]	23.30[b]	37.18[b]
1 Irrigation	483.1[a]	1.19[a]	24.69[a]	38.40[a]
Cultivar				
Rejaw	456.8[a]	1.13[a]	26.62[a]	34.41[c]
Sardari	483.6[a]	1.01[b]	20.39[c]	40.58[a]
Azar2	477.5[a]	1.14[a]	24.99[b]	38.38[b]
Nitrogen Levels				
N_1	435.8[b]	0.98[b]	22.50[b]	36.60[b]
N_2	492.7[a]	1.12[b]	24.37[a]	37.73[b]
N_3	489.4[a]	1.20[a]	25.13[a]	39.04[a]

Table 4. Continued

Treatments	Yield ($g.m^{-2}$)	Biological yield ($g.m^{-2}$)	Harvest Index (%)	Grain protein content (%)
Irrigation Levels				
Rain fed	290.6[b]	804.6[b]	36.05[a]	15.37[a]
1 Irrigation	326.5[a]	877.8[a]	37.19[a]	14.88[a]
Cultivar				
Rejaw	328.0[a]	843.2[a]	38.78[a]	14.63[b]
Sardari	289.7[c]	830.9[a]	34.85[b]	15.51[a]
Azar2	307.9[b]	849.5[a]	36.23[b]	15.24[a]
Nitrogen Levels				
N_1	267.2[c]	771.1[b]	34.68[b]	13.90[c]
N_2	318.4[b]	866.2[a]	36.81[a]	14.92[b]
N_3	339.9[a]	886.3[a]	38.37[a]	16.56[a]

Within each column (between two horizontal lines), mean followed by a different letter are significantly different at 5% level (Duncan).
N1= 50 kg urea in the fall, N2= 50 kg urea in the fall + 50 kg urea in the spring, N3=100kg urea + 20 kg urea spray