

Supplementary Materials:

Table S1: Four common definitions and methods of calculating Nitrogen Use Efficiency (NUE) [19,20].

NUE term	Calculation	Common values for cereal crops
(PFP _N) Partial Factor productivity of N applied	$PFP_N = GW/NS$	40-80 kg grain kg ⁻¹ N
(AE _N) Agronomic efficiency of applied N	$AE_N = (GW - GW_0)/NS$	10-30 kg grain kg ⁻¹ N
(PNB _N) Partial N balance (removal to use ratio)	$PNB_N = GN/NS$	Ranges from 0 to greater than 1, and depends on native soil fertility and fertility maintenance objectives. Less than 1 in nutrient deficient systems (fertility improvement). Greater than 1 in nutrient surplus systems (under replacement). Slightly less than 1 to 1 (system sustainability)
(RE _N) Apparent crop N recovery efficiency	$RE_N = (TN - TN_0)/NS$	0.3-0.5–N recovery in cereals-typical 0.5-0.8–N recovery in cereals-best management

GW – grain yield weight with N fertilizer supplied (kg ha⁻¹)

NS – amount of N fertilizer supplied (kg ha⁻¹)

GW₀ – grain yield weight (kg ha⁻¹) with no N fertilizer supplied

GN – grain N content with N fertilizer supplied (kg ha⁻¹)

TN – total N in aboveground biomass at maturity (kg ha⁻¹) with supplied N

TN₀ – total N in aboveground biomass at maturity (kg ha⁻¹) with no supplied N

Table S2: One-way ANOVA for PFP and PNB for site year 2010 and 2011 across two irrigation conditions (dryland and irrigated).

Year	NUE Measurement	Irrigation Condition	Source	df	SoS	MSS	F value	P value
2010	PFP	Dryland	Genotype	23	5576	242.4	1.153	0.331
			Residuals	48	10097	210.3		
2010	PNB	Dryland	Genotype	23	2.451	0.10656	1.157	0.326
			Residuals	48	4.419	0.09207		
2010	PFP	Irrigated	Genotype	23	2929	127.4	0.943	0.548
			Residuals	48	6486	135.1		
2010	PNB	Irrigated	Genotype	23	1.091	0.04745	0.755	0.765
			Residuals	48	3.017	0.06285		
2011	PFP	Dryland	Genotype	23	689	29.96	0.354	0.996
			Residuals	48	4064	84.68		
2011	PNB	Dryland	Genotype	23	0.3235	0.01407	0.284	0.999
			Residuals	48	2.3757	0.04949		
2011	PFP	Irrigated	Genotype	23	2344	101.9	0.963	0.525

			Residuals	48	5081	105.8		
2011	PNB	Irrigated	Genotype	23	0.8205	0.03567	1.012	0.47
			Residuals	48	1.692	0.03525		

PFPP=Partial factor productivity, PNB=Partial nitrogen balance.