Supplementary Materials:

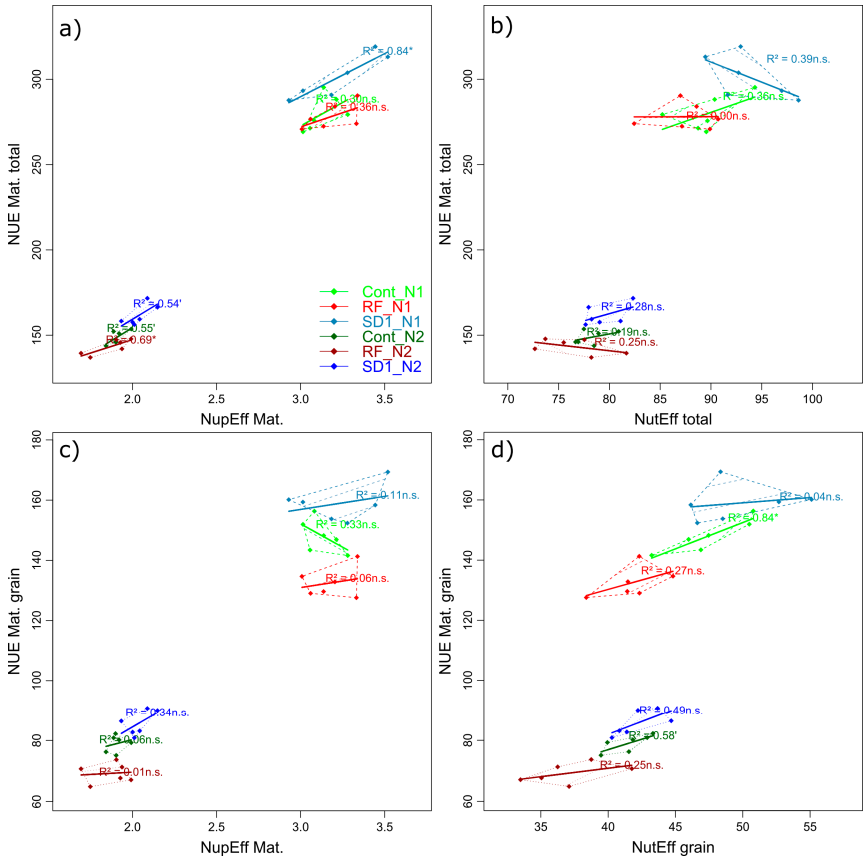
Supplementary Table 1: ANOVA results for further traits not reported in Table 4 for significant (*: $p < 0.05$, **: $p < 0.01$, **: $p < 0.001$) effects of the main plot (MP), N level (N) and cultivar (Cv) as well as two-way interactions, SD1: Sowing date 1, Cont: Control, RF: Reduced fungicide. Models are reported for the whole trial and for the combined the main plots Cont + RF and Cont + SD1 for assessing the effect of reduced fungicide or SD1 in comparison to Cont, respectively. The main effects are shaded in gray and interaction effects in blue. For the anthesis date, no cultivar effects are reported due to the missing date. 'Other leaves' denotes the leaves excluding both uppermost leaf layers, 'Ant' anthesis and 'Mat' maturity.

		Whole Trial			Cont + RF			Cont + SD1			Whole Trial			Cont + RF			Cont + SD1		
further derived DM traits	DMT spike only		*	*		*	*										**		
	DMT culm only		***	***		***	***		**	***		*	*				**		
	DMT flag leaf only			**			***			***		**					***		
	DMT flag minus1 only	*		***			***	**		***		**					***		
	DMT other leaves only	***		***		*	***	***		***		*				***	*		
	DMT all leaves only			***			***			***		**					***		
	DMTEff spike only		*			**											**		
	DMTEff culm only	*	***	**	*	***	***		***	*							*		
	DMTEff flag leaf only			***			***			*		*					*		
	DMTEff flag minus1 only	*		***			***	*		***		**					**		
	DMTEff other leaves only	*		***			***			***		*				*			
	DMTEff all leaves only			***			***			**		*					*		
	HI chaff only Ant.	***	***	***	***	**	***	***	***	***						*			
	HI culm only Ant.	***	***	***	***	***	***	***	***	***		***	*				***		
	HI flag leaf only Ant.	**	***	***		***	***	**	***	***		**					***		
	HI flag minus1 only Ant.	***	***	***		***	***	***	***	***		***	***			***	***		
	HI other leaves only Ant.	***		***	**		***	***		***		***					***		
	HI chaff only Mat.			***			***			***									
	HI culm only Mat.	***		***	***		***			***									**
	HI flag leaf only Mat.	***	***	***	*	*	***	*	**	***		***					***		
	HI flag minus1 only Mat.	**		***	*		***			***		**					***		
	HI other leaves only Mat.		*	***			***			***		*					*		
further derived N traits	NT spikes			*			*			**	*	**	**	*		**	***		
	NT culms		***			*			***	**			*				**		
	NT flag leaf		***	***		**	***		***	***		***		*			***		
	NT flag leaf-1		***	***		**	***	*	***	***		*				*	***		
	NT other leaves	***		***	**		***			***	*	*	**	*		***			
	NT leaves	*	***	***	*	*	***		***	***	*	*		*			***		
	NTEff spikes	*	***	*	*	***	**		*	*	*	**	**	*		**	***		
	NTEff culms	***	**	*	***	**				**									
	NTEff flag leaf	***	***	***	***	***	***		***	*	*	***		**	***				
	NTEff flag leaf-1	***	***	***	***	**	***		**	***									
	NTEff other leaves	***	**	***	***	**	***			***		*							
	NTEff leaves	***	***	***	***	***	***	*	***	**		***		*	***				
	NHI Ant. spikes		***	***		***	***		***	***			***			***			
	NHI Ant. culms	*	***	***	*	***	***		***	***									
	NHI Ant. flag leaf	**	**	***		*	***	*		***		***					***		
	NHI Ant. flag leaf-1	**		***			***	**		***			***			**	*		*

NHI Ant. other leaves	***	***	***	*	***	***	**	*	***		***	**		*	**		***	*
NHI Ant. all leaves			***			***			***			***		*	**			**
NHI Mat. chaff	***	***	***	**		***		***	***		**			**				
NHI Mat. culms	***		***	***		***			***									
NHI Mat. flag leaf	***	**	***	***		***	*		***		***		*	***				
NHI Mat. flag leaf-1	***		***	***		***					*							
NHI Mat. other leaves	***		***	***		***	***		***								*	
NHI Mat. all leaves	***	**	***	***		***	*		***		***		*	***				

Supplementary Table 2: Early development from leaf development to early stem elongation, evaluated in three further cultivars in Cont and SD1 in the same trial: Total aboveground dry matter (DM) and N uptake (Nup) for four sampling dates, specified by Zadok's growth stage. Grouping is based on Tukey's post-hoc-test.

Sampling Date	Sowing Date	Growth Stage	DM [kg ha^{-1}]	Nup [kg ha^{-1}]
March 15	1	22	469 b	24 b
	2	12	86 a	4.5 a
March 28	1	21	1000 b	47 b
	2	24	222 a	11 a
April 04	1	24	2107 b	93 b
	2	31	879 a	42 a
May 03	1	31	3317 b	109 b
	2	32	1980 a	83 a



Supplementary Figure 1: Pairwise trait relationships of traits of trait complexes e and f: Nitrogen use efficiency for total DM (**a**, **b**) and for grain DM (**c**, **d**) at maturity with respect to fertilized N (kg DM ha^{-1}/kg N_{fert} ha^{-1}) in relation to the multiplicative components total nitrogen uptake efficiency (NupEff, kg Nup ha^{-1}/kg N_{fert} ha^{-1}: a, b) and nitrogen utilization efficiency (NutEff, kg DM ha^{-1}/kg Nup ha^{-1}) for

total DM (b) and for grain DM (d) . N levels are distinguished by line types and color intensities (N1: Dashed lines and light colors, N2: Dotted lines and dark colors). Dashed and dotted lines delimit the bivariate data range covered by cultivars within MP × N-combinations. Colored regression lines indicate the linear trait relationships within MP × N-combinations and gray lines the regression line for the whole trial, calculated across the included data of reduced fungicide (RF), control (Cont) and sowing date 1 (SD1). Gray lines are only drawn for significant relationships ($p < 0.05$). *P*-values of regression slopes are indicated as $p < 0.01$ (***), $p < 0.01$(**), $p < 0.05$ (*) and $p < 0.1$ (′). .