

Table S1. Characteristics of nitrogen transport, and utilization efficiency in vegetative organs after anthesis.

Year	N Rate (kg ha ⁻¹)	NTAA (kg ha ⁻¹)	NTE (%)	CNTAK (%)	NGPE (kg ha ⁻¹)	NHI (%)
2019-2020	N0	62.61 c	69.97 a	52.73 b	28.99 b	81.54 a
	N120	76.95 b	70.62 a	55.10 ab	32.89 ab	81.35 a
	N150	91.08 a	67.68 a	57.76 a	35.32 a	78.38 b
	N210	80.38 ab	70.17 a	56.84 a	34.21 a	80.54 ab
	Mean	77.75	69.61	55.61	32.85	80.45
2020-2021	N0	63.53 b	69.06 b	52.41 c	30.27 b	80.99 b
	N120	72.30 b	68.49 b	55.93 b	36.65 a	79.53 c
	N150	109.89 a	71.57 ab	62.97 a	34.92 a	79.99 bc
	N210	100.17 a	72.69 a	56.33 b	33.25 ab	82.53 a
	Mean	86.47	70.45	56.91	33.77	80.76
2021-2022	N0	63.29 c	74.05 a	56.10 bc	29.87 a	83.57 a
	N120	72.68 c	69.30 c	57.72 b	32.02 a	79.63 b
	N150	94.51 a	72.15 b	63.02 a	33.02 a	80.43 b
	N210	83.04 b	69.46 c	53.98 c	30.20 a	80.82 b
	Mean	78.38	71.24	57.71	31.28	81.11
Y		**	*	*	*	ns
N		**	ns	**	**	**
Y×N		*	**	**	ns	*

Note: NTAA; Nitrogen translocation amount after anthesis; NTE; Nitrogen translocation efficiency; CNTAK; Contribution of nitrogen translocation amount to kernel; NGPE; Nitrogen grain production efficiency; NHI: Nitrogen harvest index. Within a column for each nitrogen rate, means followed by different lower-case letters are significantly different according to Tukey's HSD test (0.05). Within a column, upper-case letters indicate comparisons among two sowing method s. * and **, significant at 0.01 and 0.05 probability levels, respectively; ns, indicates not significant at 0.05 probability level.

Table S2. Effects of different nitrogen application on nitrogen use efficiency of winter wheat.

Year	N Rate (kg ha ⁻¹)	NAE (kg ha ⁻¹)	NPE (kg ha ⁻¹)	NUE (%)
2019-2020	N0	—	—	—
	N120	16.54 b	47.13 a	18.86 b
	N150	21.71 a	42.11 a	26.84 a
	N210	10.28 c	25.58 b	10.86 c
	Mean	16.18	38.27	18.85
2020-2021	N0	—	—	—
	N120	18.68 a	52.6 a	9.34 b
	N150	21.57 a	44.18 b	26.86 a
	N210	12.90 b	29.86 c	23.83 a
	Mean	17.72	42.21	20.01
2021-2022	N0	—	—	—
	N120	13.19 b	42.41 a	16.75 b
	N150	19.15 a	38.63 a	24.86 a
	N210	9.66 c	24.28 b	20.05 ab
	Mean	14.00	35.11	20.55
Y		**	**	ns
N		**	**	**
Y×N		ns	ns	**

Note: NUPE: N uptake efficiency; NUE: N use efficiency; NPE: Nitrogen partial productivity. Within a column for each nitrogen rate, means followed by different lower-case letters are significantly different according to Tukey's HSD test (0.05). Within a column, upper-case letters indicate comparisons among two sowing methods. * and **, significant at 0.01 and 0.05 probability levels, respectively; ns, indicates not significant at 0.05 probability level.