



Supplement:

Table S1. Effect of N fertilizer management on the height of ZLY819.

Year	Treatment		Tillering stage	Boot stage	Heading stage	Filling stage	Maturity Stage	
2020	N0	N0	55.63 ± 1.86c	60.17 ± 3.78c	77.95 ± 1.65e	78.73 ± 0.62e	78.77 ± 1.33d	
		P1	N1	63.30 ± 1.02b	77.13 ± 1.31b	85.47 ± 2.22d	86.9 ± 1.51d	86.95 ± 0.41c
			N2	65.57 ± 1.96ab	79.47 ± 3.46ab	89.27 ± 1.2bcd	92.43 ± 2.13abc	92.75 ± 0.62a
	N3	N3	65.67 ± 1.15ab	81.83 ± 3.59ab	91.87 ± 2.86ab	92.90 ± 1.77ab	93.47 ± 2.33a	
		P2	N1	63.87 ± 0.95b	79.17 ± 5.82ab	87.87 ± 1.70cd	88.73 ± 1.33cd	88.97 ± 1.43bc
			N2	66.00 ± 2.20ab	82.90 ± 2.11ab	92.90 ± 1.99ab	92.53 ± 2.16abc	93.20 ± 1.82a
	N3	N3	66.10 ± 1.21ab	84.07 ± 3.28a	93.17 ± 2.02ab	94.90 ± 2.75a	95.30 ± 1.35a	
		P3	N1	64.43 ± 1.92ab	80.33 ± 2.15ab	89.90 ± 1.36ab	89.87 ± 1.76bcd	90.15 ± 0.34b
			N2	67.63 ± 2.55a	84.73 ± 1.51a	94.30 ± 1.39a	95.43 ± 1.97a	95.17 ± 1.65a
	average	N3	68.03 ± 1.80a	85.03 ± 2.72a	95.20 ± 2.160a	95.47 ± 2.00a	96.03 ± 1.85a	
		P1	64.84	79.48	88.87	90.74	91.06	
		P2	65.32	82.04	91.31	92.06	92.49	
		P3	66.7	83.37	93.13	93.59	93.78	
2021	N0	N0	52.57 ± 3.07d	59.80 ± 1.10e	82.27 ± 1.72c	83.7 ± 2.97c	86.60 ± 2.54b	
		P1	N1	57.80 ± 1.16c	71.97 ± 2.69d	87.23 ± 1.76b	89.13 ± 0.92b	91.93 ± 0.66a
			N2	59.60 ± 1.64bc	75.30 ± 2.35bcd	91.07 ± 1.96ab	92.23 ± 1.51ab	92.60 ± 1.27a
	N3	N3	61.93 ± 1.13abc	75.87 ± 1.99bcd	92.90 ± 2.26a	93.67 ± 1.52a	93.43 ± 2.39a	
		P2	N1	59.70 ± 1.15bc	72.93 ± 3.32cd	90.40 ± 2.49ab	90.97 ± 2.00ab	92.67 ± 1.33a
			N2	61.23 ± 2.49abc	76.93 ± 1.83abc	92.50 ± 2.21a	92.60 ± 1.96ab	93.47 ± 2.66a
	N3	N3	63.70 ± 2.20ab	78.07 ± 1.56ab	93.27 ± 1.96a	93.50 ± 2.25a	93.67 ± 0.87a	
		P3	N1	60.77 ± 1.03abc	74.27 ± 2.12bcd	91.33 ± 2.74a	91.17 ± 2.00ab	93.13 ± 0.86a
			N2	62.90 ± 1.53ab	78.43 ± 2.16ab	93.63 ± 1.20a	92.77 ± 1.27ab	94.27 ± 1.97a
	average	N3	64.47 ± 3.17a	80.77 ± 1.25a	94.07 ± 1.07a	94.57 ± 2.05a	94.67 ± 1.97a	
		P1	59.78	74.38	90.4	91.68	92.66	
		P2	61.54	75.98	92.06	92.36	93.27	
		P3	62.71	77.82	93.01	92.83	94.02	
F value	Y		51.16**	37.46**	NS	NS	NS	
	P		5.35**	5.44**	9.11**	3.42*	5.52**	
	N		10.71	10.69**	18.40**	20.56**	20.89**	
	Y×P		NS	NS	NS	NS	NS	
	Y×N		NS	NS	NS	NS	9.18**	
	P×N		NS	NS	NS	NS	NS	
	Y×P×N		NS	NS	NS	NS	NS	

Y: year,P: the frequency of N application, N: amount of N application; the same letter after a number in the same column indicates that the treatments did not reach a significant level ($p > 0.05$). NS, not significant($p > 0.05$); * and **, significant at $P=0.05$ and $P=0.01$, respectively.

Table S2. Effect of N fertilizer management on aboveground biomass of ZLY819.

Year	Treatment	Tillering stage (g m ⁻²)	Boot stage (g m ⁻²)	Heading stage (g m ⁻²)	Filling stage (g m ⁻²)	Maturity Stage (g m ⁻²)	
2020	P1	N0	137.96 ± 12.56d	239.17 ± 33.57c	425.88 ± 22.62f	537.85 ± 23.18e	761.70 ± 20.38f
		N1	188.42 ± 33.37c	407.43 ± 50.12b	625.03 ± 37.77e	745.73 ± 42.30d	994.30 ± 8.580e
		N2	208.89 ± 22.48bc	487.05 ± 62.55ab	757.88 ± 13.33bc	903.34 ± 76.79abc	1184.61 ± 48.05bc
		N3	233.82 ± 23.35ab	503.98 ± 77.87a	752.44 ± 33.03bc	869.61 ± 63.10bc	1203.99 ± 26.72ab
	P2	N1	191.01 ± 10.52bc	394.81 ± 53.61b	662.49 ± 8.10de	833.59 ± 65.67cd	1095.3 ± 31.30d
		N2	214.30 ± 17.98bc	420.19 ± 14.74ab	792.28 ± 10.89ab	900.02 ± 45.66abc	1241.71 ± 72.65ab
		N3	233.44 ± 20.77ab	422.74 ± 41.58ab	759.97 ± 8.91b	885.42 ± 39.94abc	1189.07 ± 8.11b
	P3	N1	228.81 ± 42.55abc	448.69 ± 58.05ab	694.02 ± 72.96cd	865.39 ± 20.88bc	1108.69 ± 40.37cd
		N2	260.12 ± 36.85a	472.23 ± 68.40ab	828.63 ± 71.06a	975.71 ± 57.43a	1278.48 ± 77.98a
		N3	229.26 ± 19.64abc	504.76 ± 61.24a	778.94 ± 22.87ab	939.86 ± 88.54ab	1234.16 ± 63.47ab
	average	P1	210.38	466.15	711.787	839.56	1127.63
		P2	212.92	412.58	738.25	873.01	1175.36
		P3	239.4	475.23	767.19	926.99	1207.11
2021	P1	N0	153.80 ± 15.29b	325.80 ± 4.04d	481.76 ± 5.40e	497.07 ± 26.41e	944.00 ± 38.12g
		N1	164.45 ± 6.00ab	402.30 ± 22.39c	668.84 ± 6.03c	612.93 ± 6.08d	1198.20 ± 56.33f
		N2	162.65 ± 10.18ab	430.20 ± 7.36.00ab	761.43 ± 16.61b	672.13 ± 11.76c	1322.50 ± 33.26cde
		N3	176.35 ± 42.00ab	400.62 ± 10.03c	779.82 ± 11.13ab	731.38 ± 17.39b	1353.35 ± 66.61bcd
	P2	N1	173.00 ± 34.05ab	420.12 ± 16.56abc	612.14 ± 3.84d	630.55 ± 33.12d	1255.40 ± 26.55ef
		N2	195.83 ± 17.80a	419.59 ± 23.51abc	762.25 ± 30.25b	817.13 ± 15.72a	1383.85 ± 32.57abc
		N3	193.49 ± 9.37a	418.33 ± 13.00abc	767.22 ± 7.87b	744.89 ± 17.02b	1418.25 ± 37.51ab
	P3	N1	189.45 ± 24.69ab	407.34 ± 9.09bc	679.83 ± 12.81c	682.92 ± 19.27c	1292.95 ± 46.77de
		N2	190.50 ± 19.95ab	435.27 ± 2.29a	781.16 ± 10.50ab	719.38 ± 24.42b	1416.65 ± 37.80ab
		N3	187.00 ± 8.11ab	407.18 ± 28.68bc	799.47 ± 22.38a	721.40 ± 18.87b	1437.65 ± 53.71a
	average	P1	167.82	411.04	736.7	672.15	1291.35
		P2	187.44	419.35	713.87	730.86	1352.5
		P3	188.98	416.6	753.49	707.9	1382.42
F value	Y	34.05**	9.76**	NS	217**	181.89**	
	P	4.61*	NS	8.35**	9.59**	15.27**	
	N	NS	NS	96.71**	28.61**	59.73**	
	Y×P	NS	3.46*	3.39*	3.59*	NS	
	Y×N	NS	NS	NS	NS	NS	
	P×N	NS	NS	NS	NS	NS	
	Y×P×N	NS	NS	NS	2.94*	NS	

Y: year, P: Frequency of N application, N: amount of N application; Values followed by different lowercase letters indicate significant difference among treatments at 5% level. NS, not significant($p > 0.05$); * and **, significant at $P=0.05$ and $P=0.01$, respectively.

Table S3. Effects of N fertilizer management on dry matter growth rate, transport rate, and contribution rate of ZLY819.

Year	Treatme nt	Crop growth rate (g m ⁻² d ⁻¹)			Transfer rate of dry matter (%)	Contribution rate of dry matter (%)
		TP-MT	MT-HD	HD-MA		
2020	N0	4.93 ± 0.45d	9.60 ± 0.36e	13.99 ± 0.58c	20.23 ± 0.86f	9.51 ± 0.54e
	P1 N1	6.73 ± 1.19c	14.55 ± 2.27d	15.39 ± 1.77bc	25.47 ± 0.86e	12.87 ± 0.58d
	N2	7.46 ± 0.80bc	18.30 ± 0.59ab	17.78 ± 1.45ab	29.17 ± 4.18bcd	14.92 ± 2.07abc
	N3	8.35 ± 0.83ab	17.29 ± 1.05abc	18.81 ± 1.04a	27.13 ± 0.73de	14.20 ± 0.58bcd
	P2 N1	6.82 ± 0.38bc	15.72 ± 0.58bcd	18.03 ± 1.48ab	26.74 ± 1.87de	13.13 ± 0.52cd
	N2	7.65 ± 0.64bc	19.27 ± 0.91a	18.73 ± 2.60a	32.02 ± 1.69abc	15.87 ± 1.40ab
	N3	8.34 ± 0.74ab	17.55 ± 0.76abc	17.88 ± 0.31ab	29.68 ± 2.89bcd	15.18 ± 0.93abc
	P3 N1	8.17 ± 1.52abc	15.51 ± 3.57cd	17.28 ± 2.44ab	28.45 ± 1.16cde	13.87 ± 2.55bc
	N2	9.29 ± 1.32a	18.95 ± 1.48a	18.74 ± 0.52a	34.54 ± 5.06a	17.03 ± 2.65a
	N3	8.19 ± 0.70abc	18.32 ± 1.24ab	18.97 ± 3.59a	33.29 ± 1.29ab	15.64 ± 0.96ab
average	P1	7.51	16.71	17.33	27.25	6.56
	P2	7.60	17.51	18.21	29.48	7.08
	P3	8.55	17.59	18.33	32.10	7.72
2021	N0	5.49 ± 0.55b	10.93 ± 0.61d	19.26 ± 1.37e	21.68 ± 1.58de	8.21 ± 1.10cd
	P1 N1	5.87 ± 0.21ab	16.81 ± 0.40b	22.06 ± 2.17de	20.52 ± 1.55de	8.30 ± 1.74cd
	N2	5.81 ± 0.36ab	19.96 ± 0.79a	23.38 ± 1.34cd	27.32 ± 2.33abc	11.24 ± 1.07ab
	N3	6.30 ± 1.50ab	20.12 ± 1.75a	23.9 ± 2.86bcd	21.58 ± 0.66de	9.43 ± 2.29bc
	P2 N1	6.18 ± 1.22ab	14.64 ± 1.17c	26.80 ± 1.06ab	17.69 ± 2.60e	6.11 ± 0.85d
	N2	6.99 ± 0.64a	18.88 ± 1.53a	25.90 ± 0.59abc	21.68 ± 4.27de	8.70 ± 0.47c
	N3	6.91 ± 0.33a	19.12 ± 0.22a	27.13 ± 1.80a	31.67 ± 4.55a	12.09 ± 1.44a
	P3 N1	6.77 ± 0.88ab	16.35 ± 0.88b	25.55 ± 1.51abc	23.12 ± 3.65cd	8.79 ± 1.21c
	N2	6.80 ± 0.71ab	19.69 ± 0.38a	26.48 ± 1.59ab	28.67 ± 3.42ab	11.29 ± 1.27ab
	N3	6.68 ± 0.29ab	20.42 ± 0.93a	26.59 ± 2.17ab	24.24 ± 2.97bcd	10.21 ± 1.74abc
average	P1	5.99	18.96	23.11	23.14	9.66
	P2	6.69	17.55	26.61	23.68	8.96
	P3	6.75	18.82	26.21	25.34	10.1
F value	Y	34.05**	9.76**	NS	217**	181.89**
	P	4.61*	NS	8.35**	9.59**	15.27**
	N	NS	NS	96.71**	28.61**	59.73**
	Y×P	NS	3.46*	3.39*	3.59*	NS
	Y×N	NS	NS	NS	NS	NS
	P×N	NS	NS	NS	NS	NS
	Y×P×N	NS	NS	NS	2.94*	NS

Y: year, P: Frequency of N application, N: amount of N application; Values followed by different lowercase letters indicate significant difference among treatments at 5% level. NS, not significant ($p > 0.05$); * and **, significant at $P=0.05$ and $P=0.01$, respectively.

Table S4. Effect of N fertilizer management on N content of ZLY819.

Year	Treatment	N content in stem and sheath(%)			N content in leaves (%)			N content in spike(%)		
		Tillering	Heading	Maturity	Tillering	Heading	Maturity	Heading	Maturity	
		stage	stage	stage	stage	stage	stage	stage	stage	
2020	N0	1.30d	0.77d	0.28d	2.75d	2.13d	1.39f	1.41e	1.01e	
	P1	N1	1.54c	0.93cd	0.45bc	3.33c	2.61bc	1.58ef	1.60de	1.21bcd
		N2	1.78ab	0.97bc	0.53c	3.64ab	2.76bc	1.79cd	1.91abc	1.23bcd
		N3	1.88a	1.12ab	0.70ab	3.77a	3.02ab	1.87bc	1.98ab	1.27abc
	P2	N1	1.46c	0.95bc	0.48c	3.24c	2.60c	1.62de	1.72cd	1.14d
		N2	1.70b	0.99bc	0.58bc	3.54b	3.02ab	1.87bc	2.00ab	1.23bcd
		N3	1.84a	1.27a	0.76a	3.66ab	3.24a	2.01ab	2.06a	1.36a
	P3	N1	1.47c	1.01bc	0.51c	3.23c	2.57c	1.68cde	1.79bcd	1.17cd
		N2	1.69b	1.21a	0.79a	3.52b	2.81bc	1.74cde	2.11a	1.24bcd
		N3	1.83a	1.28a	0.74a	3.65ab	3.30a	2.14a	2.10a	1.31ab
average	P1	1.74	1.01	0.56	3.58	2.8	1.75	1.83	1.23	
	P2	1.66	1.07	0.61	3.48	2.95	1.83	1.93	1.24	
	P3	1.66	1.17	0.68	3.47	2.89	1.85	2.00	1.24	
2021	N0	0.90e	0.66f	0.47e	2.85f	2.46e	1.36c	1.49f	0.86e	
	P1	N1	1.54d	0.82ef	0.57de	3.52cd	2.81d	1.59bc	1.53ef	1.15bc
		N2	1.70bc	0.89de	0.66bcd	3.77b	3.19c	1.84a	1.85cd	1.17bc
		N3	1.81a	0.92de	0.61cde	3.94a	3.40bc	1.81ab	1.81cd	1.19ab
	P2	N1	1.48d	1.01bcd	0.63cde	3.43d	3.16c	1.76ab	1.74de	1.04cb
		N2	1.63c	1.09abc	0.74abc	3.58c	3.37bc	1.97a	2.09b	1.18ab
		N3	1.72b	1.14ab	0.82ab	3.80b	3.51ab	1.98a	1.95bc	1.21ab
	P3	N1	1.51d	0.95cde	0.66bcd	3.30e	3.22bc	1.88a	1.84cd	1.01d
		N2	1.65bc	1.23a	0.79abc	3.62c	3.40bc	1.97a	2.30a	1.19ab
		N3	1.71b	1.23a	0.85a	3.82ab	3.70a	1.97a	2.07b	1.30a
average	P1	1.69	0.88	0.61	3.74	3.14	1.75	1.73	1.17	
	P2	1.61	1.08	0.73	3.60	3.35	1.91	1.93	1.14	
	P3	1.62	1.13	0.76	3.58	3.44	1.94	2.07	1.17	
F value	Y	12.04**	NS	10.28**	33.00**	66.09**	NS	NS	17.01**	
	P	11.90**	18.62**	9.22**	14.48**	5.97**	7.23**	17.72**	NS	
	N	152.89**	19.84**	19.11**	123.71**	34.01**	22.88**	36.71**	21.95**	
	Y×P	NS	NS	NS	NS	NS	NS	NS	NS	
	Y×N	6.47**	NS	NS	NS	NS	4.18*	NS	NS	
	P×N	NS	NS	NS	NS	NS	NS	NS	2.8*	
	Y×P×N	NS	NS	NS	NS	NS	NS	NS	NS	

Y: year, P: frequency of N application, N: amount of N application. Values followed by different lowercase letters indicate significant difference among treatments at 5% level. NS, not significant($p > 0.05$); * and **, significant at $P=0.05$ and $P=0.01$, respectively.