Supplement of Biogeosciences, 11, 3031–3041, 2014
http://www.biogeosciences.net/bg-11-3031-2014/
doi:10.5194/bg-11-3031-2014-supplement

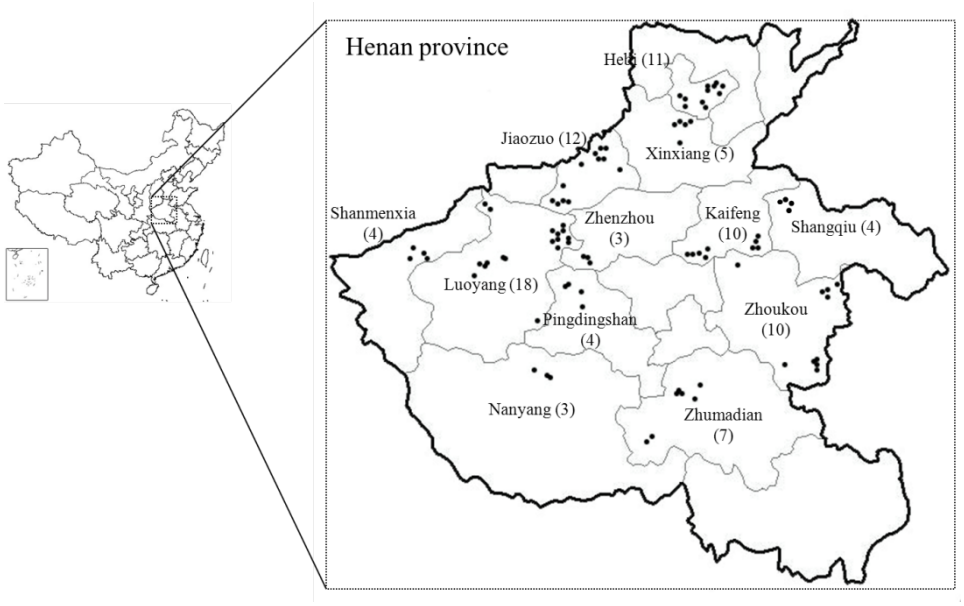
Biogeosciences Open Access

Supplement of

Determining the optimal nitrogen rate for summer maize in China by integrating agronomic, economic, and environmental aspects

G. L. Wang et al.

Correspondence to: Z. L. Cui (cuizl@cau.edu.cn)



Supplementary Fig. 1 Maize cultivation and spatial distribution of 91 experimental sites in 12 counties in Henan province for maize production in China from 2008 to 2009.

Supplementary Table 1. N rate, grain yield, reactive N losses from N fertilizer use (Nr losses), environment costs from N fertilizer production and use, including cost of global warming (C_{gw}), cost of eutrophication (C_{eu}) and cost of acidification (C_{acid}), fertilizer cost, yield benefit, economic benefit and net benefit with different N treatment over 91 sites in 12 counties in Henan province for maize production in China from 2008 to 2009.

County	Year	Site	Treatment	N rate (kg N/ha)	Grain yield (t/ha)	Nr losses (kg N/ha)				Environment costs ($/ha)				Fertilizer N cost $/ha	Yield benefit $/ha	Economic benefit $/ha	Net benefit $/ha
						N_2O emission	N leaching	NH_3 volatilization	Total	C_{gw}	C_{eu}	C_{acid}	Total				
Hebi	2008	1	N0	0	9.4	0.48	4.5	1.3	6.2	5	1	2	9	0	3383	3383	3374
	2008	1	N1	120	9.8	0.96	13.8	30.1	44.8	29	10	56	95	85	3533	3448	3353
	2008	1	N2	240	10.0	1.93	42.6	58.9	103.4	63	25	112	200	171	3602	3432	3231
	2008	1	N3	360	9.9	3.87	131.5	87.7	223.1	108	55	169	332	256	3543	3287	2955
	2008	1	N4	480	9.3	7.77	218.8	116.5	343.1	175	85	225	485	341	3361	3020	2535
	2008	2	N0	0	6.5	0.48	4.5	1.3	6.2	5	1	2	9	0	2332	2332	2322
	2008	2	N1	120	8.1	0.96	13.8	30.1	44.8	29	10	56	95	85	2895	2809	2715
	2008	2	N2	240	8.5	1.93	42.6	58.9	103.4	63	25	112	200	171	3039	2868	2668
	2008	2	N3	360	8.5	3.87	131.5	87.7	223.1	108	55	169	332	256	3043	2787	2455
	2008	2	N4	480	7.6	7.77	218.8	116.5	343.1	175	85	225	485	341	2741	2400	1914
	2008	3	N0	0	8.1	0.48	4.5	1.3	6.2	5	1	2	9	0	2905	2905	2896

2008	3	N1	120	8.9	0.96	13.8	30.1	44.8	29	10	56	95	85	3202	3116	3022
2008	3	N2	240	9.4	1.93	42.6	58.9	103.4	63	25	112	200	171	3373	3203	3002
2008	3	N3	360	9.4	3.87	131.5	87.7	223.1	108	55	169	332	256	3388	3132	2800
2008	3	N4	480	9.1	7.77	218.8	116.5	343.1	175	85	225	485	341	3276	2935	2450
2008	4	N0	0	9.1	0.48	4.5	1.3	6.2	5	1	2	9	0	3286	3286	3277
2008	4	N1	120	10.2	0.96	13.8	30.1	44.8	29	10	56	95	85	3665	3580	3485
2008	4	N2	240	10.5	1.93	42.6	58.9	103.4	63	25	112	200	171	3759	3589	3388
2008	4	N3	360	10.9	3.87	131.5	87.7	223.1	108	55	169	332	256	3916	3661	3328
2008	4	N4	480	10.5	7.77	218.8	116.5	343.1	175	85	225	485	341	3788	3447	2961
2009	5	N0	0	6.7	0.48	4.5	1.3	6.2	5	1	2	9	0	2416	2416	2407
2009	5	N1	120	7.4	0.96	13.8	30.1	44.8	29	10	56	95	85	2665	2580	2485
2009	5	N2	240	8.6	1.93	42.6	58.9	103.4	63	25	112	200	171	3105	2935	2735
2009	5	N3	360	8.1	3.87	131.5	87.7	223.1	108	55	169	332	256	2913	2657	2325
2009	5	N4	480	8.0	7.77	218.8	116.5	343.1	175	85	225	485	341	2867	2526	2040
2009	6	N0	0	8.8	0.48	4.5	1.3	6.2	5	1	2	9	0	3151	3151	3142
2009	6	N1	120	9.7	0.96	13.8	30.1	44.8	29	10	56	95	85	3484	3399	3304
2009	6	N2	240	10.5	1.93	42.6	58.9	103.4	63	25	112	200	171	3762	3592	3392
2009	6	N3	360	10.2	3.87	131.5	87.7	223.1	108	55	169	332	256	3655	3399	3067
2009	6	N4	480	9.9	7.77	218.8	116.5	343.1	175	85	225	485	341	3562	3221	2735
2009	7	N0	0	8.0	0.48	4.5	1.3	6.2	5	1	2	9	0	2887	2887	2878
2009	7	N1	120	9.3	0.96	13.8	30.1	44.8	29	10	56	95	85	3337	3252	3157

2009	7	N2	240	10.0	1.93	42.6	58.9	103.4	63	25	112	200	171	3596	3426	3226
2009	7	N3	360	9.7	3.87	131.5	87.7	223.1	108	55	169	332	256	3500	3245	2912
2009	7	N4	480	9.5	7.77	218.8	116.5	343.1	175	85	225	485	341	3405	3064	2578
2009	8	N0	0	7.7	0.48	4.5	1.3	6.2	5	1	2	9	0	2772	2772	2762
2009	8	N1	120	8.6	0.96	13.8	30.1	44.8	29	10	56	95	85	3086	3001	2906
2009	8	N2	240	10.3	1.93	42.6	58.9	103.4	63	25	112	200	171	3711	3541	3341
2009	8	N3	360	10.0	3.87	131.5	87.7	223.1	108	55	169	332	256	3611	3356	3023
2009	8	N4	480	9.4	7.77	218.8	116.5	343.1	175	85	225	485	341	3372	3031	2545
2009	9	N0	0	7.5	0.48	4.5	1.3	6.2	5	1	2	9	0	2689	2689	2680
2009	9	N1	120	9.0	0.96	13.8	30.1	44.8	29	10	56	95	85	3249	3163	3069
2009	9	N2	240	9.8	1.93	42.6	58.9	103.4	63	25	112	200	171	3515	3344	3144
2009	9	N3	360	9.7	3.87	131.5	87.7	223.1	108	55	169	332	256	3496	3241	2909
2009	9	N4	480	9.1	7.77	218.8	116.5	343.1	175	85	225	485	341	3275	2934	2449
2009	10	N0	0	7.3	0.48	4.5	1.3	6.2	5	1	2	9	0	2636	2636	2627
2009	10	N1	120	8.3	0.96	13.8	30.1	44.8	29	10	56	95	85	2983	2897	2802
2009	10	N2	240	9.8	1.93	42.6	58.9	103.4	63	25	112	200	171	3515	3345	3144
2009	10	N3	360	9.7	3.87	131.5	87.7	223.1	108	55	169	332	256	3488	3233	2901
2009	10	N4	480	9.1	7.77	218.8	116.5	343.1	175	85	225	485	341	3289	2948	2462
2009	11	N0	0	7.1	0.48	4.5	1.3	6.2	5	1	2	9	0	2564	2564	2555
2009	11	N1	120	9.2	0.96	13.8	30.1	44.8	29	10	56	95	85	3310	3225	3130
2009	11	N2	240	9.3	1.93	42.6	58.9	103.4	63	25	112	200	171	3358	3187	2987

	2009	11	N3	360	9.1	3.87	131.5	87.7	223.1	108	55	169	332	256	3283	3028	2695
	2009	11	N4	480	8.9	7.77	218.8	116.5	343.1	175	85	225	485	341	3198	2857	2372
Jiaozuo	2008	1	N0	0	9.3	0.48	4.5	1.3	6.2	5	1	2	9	0	3347	3347	3338
	2008	1	N1	120	9.7	0.96	13.8	30.1	44.8	29	10	56	95	85	3491	3406	3311
	2008	1	N2	240	10.2	1.93	42.6	58.9	103.4	63	25	112	200	171	3650	3479	3279
	2008	1	N3	360	9.4	3.87	131.5	87.7	223.1	108	55	169	332	256	3361	3106	2773
	2008	1	N4	480	8.8	7.77	218.8	116.5	343.1	175	85	225	485	341	3175	2834	2349
	2008	2	N0	0	9.7	0.48	4.5	1.3	6.2	5	1	2	9	0	3484	3484	3475
	2008	2	N1	120	10.5	0.96	13.8	30.1	44.8	29	10	56	95	85	3771	3686	3591
	2008	2	N2	240	11.2	1.93	42.6	58.9	103.4	63	25	112	200	171	4017	3846	3646
	2008	2	N3	360	10.8	3.87	131.5	87.7	223.1	108	55	169	332	256	3887	3631	3299
	2008	2	N4	480	10.6	7.77	218.8	116.5	343.1	175	85	225	485	341	3796	3455	2970
	2008	3	N0	0	8.0	0.48	4.5	1.3	6.2	5	1	2	9	0	2891	2891	2882
	2008	3	N1	120	10.4	0.96	13.8	30.1	44.8	29	10	56	95	85	3732	3647	3552
	2008	3	N2	240	10.9	1.93	42.6	58.9	103.4	63	25	112	200	171	3920	3750	3549
	2008	3	N3	360	11.4	3.87	131.5	87.7	223.1	108	55	169	332	256	4101	3845	3513
	2008	3	N4	480	9.5	7.77	218.8	116.5	343.1	175	85	225	485	341	3399	3058	2572
	2008	4	N0	0	10.8	0.48	4.5	1.3	6.2	5	1	2	9	0	3887	3887	3877
	2008	4	N1	105	11.5	0.88	12.0	26.5	39.3	25	8	49	83	75	4150	4076	3993
	2008	4	N2	210	11.9	1.62	32.1	51.7	85.4	54	20	98	172	149	4278	4129	3957
	2008	4	N3	315	11.9	2.98	86.2	76.9	166.0	90	41	147	278	224	4294	4070	3792

2008	4	N4	420	11.3	5.49	163.5	102.1	271.0	138	67	197	402	298	4058	3760	3358
2008	5	N0	0	8.1	0.48	4.5	1.3	6.2	5	1	2	9	0	2924	2924	2915
2008	5	N1	105	9.1	0.88	12.0	26.5	39.3	25	8	49	83	75	3287	3213	3130
2008	5	N2	210	9.8	1.62	32.1	51.7	85.4	54	20	98	172	149	3515	3366	3194
2008	5	N3	315	10.4	2.98	86.2	76.9	166.0	90	41	147	278	224	3727	3503	3225
2008	5	N4	420	9.4	5.49	163.5	102.1	271.0	138	67	197	402	298	3371	3073	2671
2008	6	N0	0	7.7	0.48	4.5	1.3	6.2	5	1	2	9	0	2784	2784	2775
2008	6	N1	105	9.4	0.88	12.0	26.5	39.3	25	8	49	83	75	3367	3293	3210
2008	6	N2	210	9.9	1.62	32.1	51.7	85.4	54	20	98	172	149	3563	3414	3242
2008	6	N3	315	10.2	2.98	86.2	76.9	166.0	90	41	147	278	224	3683	3459	3182
2008	6	N4	420	9.6	5.49	163.5	102.1	271.0	138	67	197	402	298	3447	3149	2747
2009	7	N0	0	7.8	0.48	4.5	1.3	6.2	5	1	2	9	0	2804	2804	2795
2009	7	N1	120	8.4	0.96	13.8	30.1	44.8	29	10	56	95	85	3025	2940	2845
2009	7	N2	240	9.0	1.93	42.6	58.9	103.4	63	25	112	200	171	3225	3054	2854
2009	7	N3	360	8.3	3.87	131.5	87.7	223.1	108	55	169	332	256	2979	2724	2391
2009	7	N4	480	8.2	7.77	218.8	116.5	343.1	175	85	225	485	341	2952	2611	2125
2009	8	N0	0	8.3	0.48	4.5	1.3	6.2	5	1	2	9	0	2966	2966	2957
2009	8	N1	120	9.1	0.96	13.8	30.1	44.8	29	10	56	95	85	3288	3203	3108
2009	8	N2	240	8.6	1.93	42.6	58.9	103.4	63	25	112	200	171	3088	2917	2717
2009	8	N3	360	8.4	3.87	131.5	87.7	223.1	108	55	169	332	256	3004	2748	2416
2009	8	N4	480	7.9	7.77	218.8	116.5	343.1	175	85	225	485	341	2850	2509	2023

	2009	9	N0	0	8.5	0.48	4.5	1.3	6.2	5	1	2	9	0	3060	3060	3051
	2009	9	N1	120	9.9	0.96	13.8	30.1	44.8	29	10	56	95	85	3553	3467	3373
	2009	9	N2	240	9.1	1.93	42.6	58.9	103.4	63	25	112	200	171	3273	3103	2903
	2009	9	N3	360	8.8	3.87	131.5	87.7	223.1	108	55	169	332	256	3154	2899	2567
	2009	9	N4	480	8.3	7.77	218.8	116.5	343.1	175	85	225	485	341	2991	2650	2164
	2009	10	N0	0	7.1	0.48	4.5	1.3	6.2	5	1	2	9	0	2564	2564	2555
	2009	10	N1	120	8.8	0.96	13.8	30.1	44.8	29	10	56	95	85	3169	3084	2989
	2009	10	N2	240	8.6	1.93	42.6	58.9	103.4	63	25	112	200	171	3106	2936	2735
	2009	10	N3	360	8.0	3.87	131.5	87.7	223.1	108	55	169	332	256	2859	2603	2271
	2009	10	N4	480	7.6	7.77	218.8	116.5	343.1	175	85	225	485	341	2749	2408	1923
	2009	11	N0	0	3.2	0.48	4.5	1.3	6.2	5	1	2	9	0	1151	1151	1142
	2009	11	N1	105	4.9	0.88	12.0	26.5	39.3	25	8	49	83	75	1753	1678	1595
	2009	11	N2	210	6.3	1.62	32.1	51.7	85.4	54	20	98	172	149	2262	2113	1941
	2009	11	N3	315	5.2	2.98	86.2	76.9	166.0	90	41	147	278	224	1867	1643	1365
	2009	11	N4	420	4.8	5.49	163.5	102.1	271.0	138	67	197	402	298	1734	1436	1034
	2009	12	N0	0	3.4	0.48	4.5	1.3	6.2	5	1	2	9	0	1212	1212	1203
	2009	12	N1	105	5.3	0.88	12.0	26.5	39.3	25	8	49	83	75	1894	1819	1736
	2009	12	N2	210	6.9	1.62	32.1	51.7	85.4	54	20	98	172	149	2491	2341	2169
	2009	12	N3	315	6.3	2.98	86.2	76.9	166.0	90	41	147	278	224	2278	2055	1777
	2009	12	N4	420	5.1	5.49	163.5	102.1	271.0	138	67	197	402	298	1834	1536	1134
Kaifeng	2008	1	N0	0	6.0	0.48	4.5	1.3	6.2	5	1	2	9	0	2158	2158	2149

2008	1	N1	120	7.1	0.96	13.8	30.1	44.8	29	10	56	95	85	2553	2468	2373
2008	1	N2	240	9.6	1.93	42.6	58.9	103.4	63	25	112	200	171	3453	3282	3082
2008	1	N3	360	8.7	3.87	131.5	87.7	223.1	108	55	169	332	256	3131	2875	2543
2008	1	N4	480	7.9	7.77	218.8	116.5	343.1	175	85	225	485	341	2846	2505	2019
2008	2	N0	0	7.9	0.48	4.5	1.3	6.2	5	1	2	9	0	2858	2858	2848
2008	2	N1	120	9.4	0.96	13.8	30.1	44.8	29	10	56	95	85	3381	3295	3201
2008	2	N2	240	9.5	1.93	42.6	58.9	103.4	63	25	112	200	171	3412	3242	3041
2008	2	N3	360	8.8	3.87	131.5	87.7	223.1	108	55	169	332	256	3181	2925	2593
2008	2	N4	480	8.8	7.77	218.8	116.5	343.1	175	85	225	485	341	3160	2819	2333
2008	3	N0	0	6.4	0.48	4.5	1.3	6.2	5	1	2	9	0	2312	2312	2303
2008	3	N1	120	8.1	0.96	13.8	30.1	44.8	29	10	56	95	85	2904	2819	2724
2008	3	N2	240	8.4	1.93	42.6	58.9	103.4	63	25	112	200	171	3033	2862	2662
2008	3	N3	360	8.4	3.87	131.5	87.7	223.1	108	55	169	332	256	3020	2765	2432
2008	3	N4	480	8.0	7.77	218.8	116.5	343.1	175	85	225	485	341	2880	2539	2054
2008	4	N0	0	7.7	0.48	4.5	1.3	6.2	5	1	2	9	0	2767	2767	2758
2008	4	N1	120	8.5	0.96	13.8	30.1	44.8	29	10	56	95	85	3043	2958	2863
2008	4	N2	240	9.2	1.93	42.6	58.9	103.4	63	25	112	200	171	3303	3132	2932
2008	4	N3	360	8.8	3.87	131.5	87.7	223.1	108	55	169	332	256	3145	2890	2558
2008	4	N4	480	8.5	7.77	218.8	116.5	343.1	175	85	225	485	341	3064	2723	2238
2008	5	N0	0	7.0	0.48	4.5	1.3	6.2	5	1	2	9	0	2516	2516	2507
2008	5	N1	105	7.4	0.88	12.0	26.5	39.3	25	8	49	83	75	2667	2592	2509

2008	5	N2	210	8.3	1.62	32.1	51.7	85.4	54	20	98	172	149	2974	2825	2652
2008	5	N3	315	7.7	2.98	86.2	76.9	166.0	90	41	147	278	224	2765	2541	2263
2008	5	N4	420	7.6	5.49	163.5	102.1	271.0	138	67	197	402	298	2728	2430	2028
2008	6	N0	0	7.3	0.48	4.5	1.3	6.2	5	1	2	9	0	2630	2630	2620
2008	6	N1	105	7.9	0.88	12.0	26.5	39.3	25	8	49	83	75	2856	2781	2698
2008	6	N2	210	8.6	1.62	32.1	51.7	85.4	54	20	98	172	149	3081	2932	2759
2008	6	N3	315	8.0	2.98	86.2	76.9	166.0	90	41	147	278	224	2885	2661	2383
2008	6	N4	420	7.5	5.49	163.5	102.1	271.0	138	67	197	402	298	2707	2409	2007
2008	7	N0	0	5.8	0.48	4.5	1.3	6.2	5	1	2	9	0	2075	2075	2066
2008	7	N1	105	6.5	0.88	12.0	26.5	39.3	25	8	49	83	75	2332	2258	2175
2008	7	N2	210	7.8	1.62	32.1	51.7	85.4	54	20	98	172	149	2791	2642	2469
2008	7	N3	315	7.7	2.98	86.2	76.9	166.0	90	41	147	278	224	2764	2540	2262
2008	7	N4	420	7.2	5.49	163.5	102.1	271.0	138	67	197	402	298	2598	2300	1898
2009	8	N0	0	8.4	0.48	4.5	1.3	6.2	5	1	2	9	0	3027	3027	3018
2009	8	N1	105	9.4	0.88	12.0	26.5	39.3	25	8	49	83	75	3377	3302	3220
2009	8	N2	210	9.0	1.62	32.1	51.7	85.4	54	20	98	172	149	3236	3086	2914
2009	8	N3	315	8.9	2.98	86.2	76.9	166.0	90	41	147	278	224	3199	2976	2698
2009	8	N4	420	8.8	5.49	163.5	102.1	271.0	138	67	197	402	298	3170	2871	2469
2009	9	N0	0	5.4	0.48	4.5	1.3	6.2	5	1	2	9	0	1943	1943	1934
2009	9	N1	105	6.6	0.88	12.0	26.5	39.3	25	8	49	83	75	2363	2289	2206
2009	9	N2	210	7.2	1.62	32.1	51.7	85.4	54	20	98	172	149	2570	2421	2249

	2009	9	N3	315	6.2	2.98	86.2	76.9	166.0	90	41	147	278	224	2220	1996	1718
	2009	9	N4	420	6.5	5.49	163.5	102.1	271.0	138	67	197	402	298	2340	2041	1640
	2009	10	N0	0	8.2	0.48	4.5	1.3	6.2	5	1	2	9	0	2939	2939	2930
	2009	10	N1	105	9.0	0.88	12.0	26.5	39.3	25	8	49	83	75	3227	3152	3069
	2009	10	N2	210	9.7	1.62	32.1	51.7	85.4	54	20	98	172	149	3472	3323	3151
	2009	10	N3	315	9.0	2.98	86.2	76.9	166.0	90	41	147	278	224	3234	3010	2733
	2009	10	N4	420	8.9	5.49	163.5	102.1	271.0	138	67	197	402	298	3184	2886	2484
Luoyang	2008	1	N0	0	7.5	0.48	4.5	1.3	6.2	5	1	2	9	0	2687	2687	2678
	2008	1	N1	120	8.8	0.96	13.8	30.1	44.8	29	10	56	95	85	3154	3069	2974
	2008	1	N2	240	9.7	1.93	42.6	58.9	103.4	63	25	112	200	171	3469	3298	3098
	2008	1	N3	360	9.6	3.87	131.5	87.7	223.1	108	55	169	332	256	3445	3189	2857
	2008	1	N4	480	9.4	7.77	218.8	116.5	343.1	175	85	225	485	341	3395	3054	2569
	2008	2	N0	0	6.7	0.48	4.5	1.3	6.2	5	1	2	9	0	2396	2396	2387
	2008	2	N1	120	7.5	0.96	13.8	30.1	44.8	29	10	56	95	85	2711	2626	2531
	2008	2	N2	240	8.4	1.93	42.6	58.9	103.4	63	25	112	200	171	3023	2852	2652
	2008	2	N3	360	8.3	3.87	131.5	87.7	223.1	108	55	169	332	256	2993	2737	2405
	2008	2	N4	480	8.0	7.77	218.8	116.5	343.1	175	85	225	485	341	2888	2547	2061
	2008	3	N0	0	6.9	0.48	4.5	1.3	6.2	5	1	2	9	0	2489	2489	2480
	2008	3	N1	120	7.9	0.96	13.8	30.1	44.8	29	10	56	95	85	2828	2743	2648
	2008	3	N2	240	8.8	1.93	42.6	58.9	103.4	63	25	112	200	171	3166	2996	2796
	2008	3	N3	360	8.7	3.87	131.5	87.7	223.1	108	55	169	332	256	3115	2859	2527

2008	3	N4	480	8.4	7.77	218.8	116.5	343.1	175	85	225	485	341	3008	2667	2181
2008	4	N0	0	7.6	0.48	4.5	1.3	6.2	5	1	2	9	0	2720	2720	2711
2008	4	N1	120	8.8	0.96	13.8	30.1	44.8	29	10	56	95	85	3145	3060	2965
2008	4	N2	240	9.8	1.93	42.6	58.9	103.4	63	25	112	200	171	3520	3349	3149
2008	4	N3	360	10.1	3.87	131.5	87.7	223.1	108	55	169	332	256	3619	3363	3031
2008	4	N4	480	9.5	7.77	218.8	116.5	343.1	175	85	225	485	341	3427	3086	2601
2008	5	N0	0	5.2	0.48	4.5	1.3	6.2	5	1	2	9	0	1857	1857	1848
2008	5	N1	120	6.1	0.96	13.8	30.1	44.8	29	10	56	95	85	2211	2125	2031
2008	5	N2	240	6.7	1.93	42.6	58.9	103.4	63	25	112	200	171	2414	2244	2044
2008	5	N3	360	6.5	3.87	131.5	87.7	223.1	108	55	169	332	256	2346	2090	1758
2008	5	N4	480	6.3	7.77	218.8	116.5	343.1	175	85	225	485	341	2280	1939	1453
2009	6	N0	0	6.8	0.48	4.5	1.3	6.2	5	1	2	9	0	2451	2451	2441
2009	6	N1	120	7.3	0.96	13.8	30.1	44.8	29	10	56	95	85	2640	2555	2460
2009	6	N2	240	8.5	1.93	42.6	58.9	103.4	63	25	112	200	171	3042	2872	2672
2009	6	N3	360	8.0	3.87	131.5	87.7	223.1	108	55	169	332	256	2867	2611	2279
2009	6	N4	480	7.6	7.77	218.8	116.5	343.1	175	85	225	485	341	2748	2407	1922
2009	7	N0	0	5.5	0.48	4.5	1.3	6.2	5	1	2	9	0	1983	1983	1974
2009	7	N1	120	6.3	0.96	13.8	30.1	44.8	29	10	56	95	85	2252	2167	2072
2009	7	N2	240	6.7	1.93	42.6	58.9	103.4	63	25	112	200	171	2406	2236	2035
2009	7	N3	360	6.3	3.87	131.5	87.7	223.1	108	55	169	332	256	2279	2023	1691
2009	7	N4	480	6.2	7.77	218.8	116.5	343.1	175	85	225	485	341	2221	1880	1395

2009	8	N0	0	4.6	0.48	4.5	1.3	6.2	5	1	2	9	0	1645	1645	1636
2009	8	N1	120	6.1	0.96	13.8	30.1	44.8	29	10	56	95	85	2185	2099	2005
2009	8	N2	240	6.2	1.93	42.6	58.9	103.4	63	25	112	200	171	2212	2042	1841
2009	8	N3	360	6.1	3.87	131.5	87.7	223.1	108	55	169	332	256	2203	1947	1615
2009	8	N4	480	6.0	7.77	218.8	116.5	343.1	175	85	225	485	341	2144	1803	1317
2009	9	N0	0	7.0	0.48	4.5	1.3	6.2	5	1	2	9	0	2534	2534	2525
2009	9	N1	120	8.1	0.96	13.8	30.1	44.8	29	10	56	95	85	2897	2811	2717
2009	9	N2	240	8.8	1.93	42.6	58.9	103.4	63	25	112	200	171	3157	2987	2787
2009	9	N3	360	8.4	3.87	131.5	87.7	223.1	108	55	169	332	256	3004	2748	2416
2009	9	N4	480	7.9	7.77	218.8	116.5	343.1	175	85	225	485	341	2846	2505	2020
2009	10	N0	0	6.9	0.48	4.5	1.3	6.2	5	1	2	9	0	2465	2465	2456
2009	10	N1	120	8.0	0.96	13.8	30.1	44.8	29	10	56	95	85	2861	2776	2681
2009	10	N2	240	8.4	1.93	42.6	58.9	103.4	63	25	112	200	171	3020	2849	2649
2009	10	N3	360	8.6	3.87	131.5	87.7	223.1	108	55	169	332	256	3076	2821	2489
2009	10	N4	480	7.7	7.77	218.8	116.5	343.1	175	85	225	485	341	2783	2442	1957
2009	11	N0	0	5.6	0.48	4.5	1.3	6.2	5	1	2	9	0	2022	2022	2013
2009	11	N1	120	6.3	0.96	13.8	30.1	44.8	29	10	56	95	85	2253	2167	2073
2009	11	N2	240	6.9	1.93	42.6	58.9	103.4	63	25	112	200	171	2483	2313	2113
2009	11	N3	360	6.6	3.87	131.5	87.7	223.1	108	55	169	332	256	2366	2111	1779
2009	11	N4	480	6.0	7.77	218.8	116.5	343.1	175	85	225	485	341	2142	1801	1315
2009	12	N0	0	4.7	0.48	4.5	1.3	6.2	5	1	2	9	0	1690	1690	1680

2009	12	N1	120	5.5	0.96	13.8	30.1	44.8	29	10	56	95	85	1992	1907	1812
2009	12	N2	240	6.0	1.93	42.6	58.9	103.4	63	25	112	200	171	2157	1986	1786
2009	12	N3	360	5.4	3.87	131.5	87.7	223.1	108	55	169	332	256	1935	1680	1347
2009	12	N4	480	4.8	7.77	218.8	116.5	343.1	175	85	225	485	341	1721	1380	895
2009	13	N0	0	6.6	0.48	4.5	1.3	6.2	5	1	2	9	0	2364	2364	2355
2009	13	N1	90	7.1	0.81	10.4	22.9	34.1	21	7	42	71	64	2554	2490	2419
2009	13	N2	180	7.9	1.36	24.2	44.5	70.1	45	16	84	146	128	2844	2717	2571
2009	13	N3	270	7.1	2.30	56.4	66.1	124.8	73	30	126	230	192	2560	2368	2138
2009	13	N4	360	6.7	3.87	123.3	87.7	214.8	108	53	169	330	256	2411	2155	1825
2009	14	N0	0	7.4	0.48	4.5	1.3	6.2	5	1	2	9	0	2666	2666	2657
2009	14	N1	90	7.7	0.81	10.4	22.9	34.1	21	7	42	71	64	2779	2715	2644
2009	14	N2	180	7.8	1.36	24.2	44.5	70.1	45	16	84	146	128	2813	2685	2539
2009	14	N3	270	8.1	2.30	56.4	66.1	124.8	73	30	126	230	192	2910	2718	2489
2009	14	N4	360	7.5	3.87	123.3	87.7	214.8	108	53	169	330	256	2708	2452	2122
2009	15	N0	0	8.0	0.48	4.5	1.3	6.2	5	1	2	9	0	2869	2869	2860
2009	15	N1	90	8.5	0.81	10.4	22.9	34.1	21	7	42	71	64	3058	2994	2923
2009	15	N2	180	8.9	1.36	24.2	44.5	70.1	45	16	84	146	128	3201	3073	2928
2009	15	N3	270	8.6	2.30	56.4	66.1	124.8	73	30	126	230	192	3108	2917	2687
2009	15	N4	360	8.4	3.87	123.3	87.7	214.8	108	53	169	330	256	3021	2766	2436
2009	16	N0	0	6.7	0.48	4.5	1.3	6.2	5	1	2	9	0	2398	2398	2389
2009	16	N1	90	7.3	0.81	10.4	22.9	34.1	21	7	42	71	64	2627	2563	2493

	2009	16	N2	180	7.8	1.36	24.2	44.5	70.1	45	16	84	146	128	2812	2684	2538
	2009	16	N3	270	7.4	2.30	56.4	66.1	124.8	73	30	126	230	192	2656	2464	2234
	2009	16	N4	360	6.8	3.87	123.3	87.7	214.8	108	53	169	330	256	2450	2194	1864
	2009	17	N0	0	7.0	0.48	4.5	1.3	6.2	5	1	2	9	0	2515	2515	2506
	2009	17	N1	90	7.8	0.81	10.4	22.9	34.1	21	7	42	71	64	2794	2730	2660
	2009	17	N2	180	8.4	1.36	24.2	44.5	70.1	45	16	84	146	128	3007	2879	2734
	2009	17	N3	270	9.5	2.30	56.4	66.1	124.8	73	30	126	230	192	3414	3222	2992
	2009	17	N4	360	7.4	3.87	123.3	87.7	214.8	108	53	169	330	256	2649	2393	2063
	2009	18	N0	0	8.0	0.48	4.5	1.3	6.2	5	1	2	9	0	2882	2882	2873
	2009	18	N1	90	8.4	0.81	10.4	22.9	34.1	21	7	42	71	64	3020	2956	2885
	2009	18	N2	180	8.6	1.36	24.2	44.5	70.1	45	16	84	146	128	3088	2960	2815
	2009	18	N3	270	8.3	2.30	56.4	66.1	124.8	73	30	126	230	192	2985	2793	2563
	2009	18	N4	360	8.0	3.87	123.3	87.7	214.8	108	53	169	330	256	2860	2604	2274
Nanyang	2009	1	N0	0	6.3	0.48	4.5	1.3	6.2	5	1	2	9	0	2262	2262	2253
	2009	1	N1	120	7.1	0.96	13.8	30.1	44.8	29	10	56	95	85	2567	2481	2387
	2009	1	N2	240	7.5	1.93	42.6	58.9	103.4	63	25	112	200	171	2701	2531	2331
	2009	1	N3	360	7.4	3.87	131.5	87.7	223.1	108	55	169	332	256	2660	2404	2072
	2009	1	N4	480	6.8	7.77	218.8	116.5	343.1	175	85	225	485	341	2428	2087	1602
	2009	2	N0	0	6.2	0.48	4.5	1.3	6.2	5	1	2	9	0	2246	2246	2236
	2009	2	N1	120	7.2	0.96	13.8	30.1	44.8	29	10	56	95	85	2573	2488	2393
	2009	2	N2	240	6.7	1.93	42.6	58.9	103.4	63	25	112	200	171	2403	2233	2032

	2009	2	N3	360	6.7	3.87	131.5	87.7	223.1	108	55	169	332	256	2422	2166	1834
	2009	2	N4	480	6.6	7.77	218.8	116.5	343.1	175	85	225	485	341	2369	2028	1542
	2009	3	N0	0	5.4	0.48	4.5	1.3	6.2	5	1	2	9	0	1957	1957	1948
	2009	3	N1	120	7.2	0.96	13.8	30.1	44.8	29	10	56	95	85	2586	2501	2406
	2009	3	N2	240	7.4	1.93	42.6	58.9	103.4	63	25	112	200	171	2663	2492	2292
	2009	3	N3	360	7.1	3.87	131.5	87.7	223.1	108	55	169	332	256	2559	2303	1971
	2009	3	N4	480	7.1	7.77	218.8	116.5	343.1	175	85	225	485	341	2559	2218	1732
Pingdingshan	2009	1	N0	0	3.7	0.48	4.5	1.3	6.2	5	1	2	9	0	1325	1325	1316
	2009	1	N1	120	4.4	0.96	13.8	30.1	44.8	29	10	56	95	85	1583	1498	1403
	2009	1	N2	240	6.2	1.93	42.6	58.9	103.4	63	25	112	200	171	2239	2068	1868
	2009	1	N3	360	5.5	3.87	131.5	87.7	223.1	108	55	169	332	256	1967	1711	1379
	2009	1	N4	480	5.0	7.77	218.8	116.5	343.1	175	85	225	485	341	1785	1444	959
	2009	2	N0	0	3.8	0.48	4.5	1.3	6.2	5	1	2	9	0	1366	1366	1357
	2009	2	N1	120	4.5	0.96	13.8	30.1	44.8	29	10	56	95	85	1632	1547	1452
	2009	2	N2	240	6.4	1.93	42.6	58.9	103.4	63	25	112	200	171	2308	2137	1937
	2009	2	N3	360	5.6	3.87	131.5	87.7	223.1	108	55	169	332	256	2027	1772	1440
	2009	2	N4	480	5.1	7.77	218.8	116.5	343.1	175	85	225	485	341	1841	1500	1014
	2009	3	N0	0	4.8	0.48	4.5	1.3	6.2	5	1	2	9	0	1723	1723	1713
	2009	3	N1	120	5.7	0.96	13.8	30.1	44.8	29	10	56	95	85	2058	1973	1878
	2009	3	N2	240	8.1	1.93	42.6	58.9	103.4	63	25	112	200	171	2910	2740	2540
	2009	3	N3	360	7.1	3.87	131.5	87.7	223.1	108	55	169	332	256	2557	2301	1969

	2009	3	N4	480	6.5	7.77	218.8	116.5	343.1	175	85	225	485	341	2321	1980	1495
	2009	4	N0	0	3.2	0.48	4.5	1.3	6.2	5	1	2	9	0	1138	1138	1129
	2009	4	N1	120	3.8	0.96	13.8	30.1	44.8	29	10	56	95	85	1360	1275	1180
	2009	4	N2	240	5.4	1.93	42.6	58.9	103.4	63	25	112	200	171	1923	1753	1552
	2009	4	N3	360	4.7	3.87	131.5	87.7	223.1	108	55	169	332	256	1690	1434	1102
	2009	4	N4	480	4.3	7.77	218.8	116.5	343.1	175	85	225	485	341	1534	1193	707
Shanmenxia	2009	1	N0	0	4.5	0.48	4.5	1.3	6.2	5	1	2	9	0	1609	1609	1599
	2009	1	N1	120	5.9	0.96	13.8	30.1	44.8	29	10	56	95	85	2127	2042	1947
	2009	1	N2	240	6.7	1.93	42.6	58.9	103.4	63	25	112	200	171	2418	2247	2047
	2009	1	N3	360	6.3	3.87	131.5	87.7	223.1	108	55	169	332	256	2256	2000	1668
	2009	1	N4	480	6.0	7.77	218.8	116.5	343.1	175	85	225	485	341	2172	1831	1346
	2009	2	N0	0	5.6	0.48	4.5	1.3	6.2	5	1	2	9	0	2016	2016	2007
	2009	2	N1	120	6.0	0.96	13.8	30.1	44.8	29	10	56	95	85	2142	2057	1962
	2009	2	N2	240	7.3	1.93	42.6	58.9	103.4	63	25	112	200	171	2636	2466	2266
	2009	2	N3	360	6.8	3.87	131.5	87.7	223.1	108	55	169	332	256	2433	2177	1845
	2009	2	N4	480	6.3	7.77	218.8	116.5	343.1	175	85	225	485	341	2259	1918	1433
	2009	3	N0	0	4.3	0.48	4.5	1.3	6.2	5	1	2	9	0	1528	1528	1519
	2009	3	N1	120	5.5	0.96	13.8	30.1	44.8	29	10	56	95	85	1992	1907	1812
	2009	3	N2	240	6.7	1.93	42.6	58.9	103.4	63	25	112	200	171	2391	2220	2020
	2009	3	N3	360	6.0	3.87	131.5	87.7	223.1	108	55	169	332	256	2172	1916	1584
	2009	3	N4	480	5.8	7.77	218.8	116.5	343.1	175	85	225	485	341	2097	1756	1271

	2009	4	N0	0	6.1	0.48	4.5	1.3	6.2	5	1	2	9	0	2175	2175	2166
	2009	4	N1	120	6.3	0.96	13.8	30.1	44.8	29	10	56	95	85	2271	2186	2091
	2009	4	N2	240	7.4	1.93	42.6	58.9	103.4	63	25	112	200	171	2660	2490	2290
	2009	4	N3	360	7.2	3.87	131.5	87.7	223.1	108	55	169	332	256	2570	2315	1983
	2009	4	N4	480	6.7	7.77	218.8	116.5	343.1	175	85	225	485	341	2418	2077	1591
Shangqiu	2009	1	N0	0	6.8	0.48	4.5	1.3	6.2	5	1	2	9	0	2428	2428	2418
	2009	1	N1	120	7.8	0.96	13.8	30.1	44.8	29	10	56	95	85	2797	2712	2617
	2009	1	N2	240	8.8	1.93	42.6	58.9	103.4	63	25	112	200	171	3165	2995	2794
	2009	1	N3	360	8.4	3.87	131.5	87.7	223.1	108	55	169	332	256	3014	2758	2426
	2009	1	N4	480	8.5	7.77	218.8	116.5	343.1	175	85	225	485	341	3039	2698	2212
	2009	2	N0	0	5.9	0.48	4.5	1.3	6.2	5	1	2	9	0	2111	2111	2102
	2009	2	N1	120	8.2	0.96	13.8	30.1	44.8	29	10	56	95	85	2934	2849	2754
	2009	2	N2	240	8.7	1.93	42.6	58.9	103.4	63	25	112	200	171	3122	2951	2751
	2009	2	N3	360	8.4	3.87	131.5	87.7	223.1	108	55	169	332	256	3006	2750	2418
	2009	2	N4	480	7.7	7.77	218.8	116.5	343.1	175	85	225	485	341	2751	2410	1925
	2009	3	N0	0	6.7	0.48	4.5	1.3	6.2	5	1	2	9	0	2391	2391	2381
	2009	3	N1	120	8.3	0.96	13.8	30.1	44.8	29	10	56	95	85	2980	2894	2799
	2009	3	N2	240	8.8	1.93	42.6	58.9	103.4	63	25	112	200	171	3151	2981	2781
	2009	3	N3	360	9.2	3.87	131.5	87.7	223.1	108	55	169	332	256	3293	3037	2705
	2009	3	N4	480	9.0	7.77	218.8	116.5	343.1	175	85	225	485	341	3236	2895	2410
	2009	4	N0	0	6.3	0.48	4.5	1.3	6.2	5	1	2	9	0	2277	2277	2268

	2009	4	N1	120	8.2	0.96	13.8	30.1	44.8	29	10	56	95	85	2947	2862	2767
	2009	4	N2	240	8.5	1.93	42.6	58.9	103.4	63	25	112	200	171	3063	2893	2692
	2009	4	N3	360	9.0	3.87	131.5	87.7	223.1	108	55	169	332	256	3235	2980	2647
	2009	4	N4	480	8.4	7.77	218.8	116.5	343.1	175	85	225	485	341	3035	2694	2208
Xinxiang	2008	1	N0	0	6.8	0.48	4.5	1.3	6.2	5	1	2	9	0	2443	2443	2433
	2008	1	N1	120	7.3	0.96	13.8	30.1	44.8	29	10	56	95	85	2637	2552	2457
	2008	1	N2	240	7.8	1.93	42.6	58.9	103.4	63	25	112	200	171	2795	2624	2424
	2008	1	N3	360	7.1	3.87	131.5	87.7	223.1	108	55	169	332	256	2552	2297	1964
	2008	1	N4	480	6.7	7.77	218.8	116.5	343.1	175	85	225	485	341	2403	2062	1577
	2008	2	N0	0	6.4	0.48	4.5	1.3	6.2	5	1	2	9	0	2315	2315	2306
	2008	2	N1	120	8.1	0.96	13.8	30.1	44.8	29	10	56	95	85	2919	2834	2739
	2008	2	N2	240	8.7	1.93	42.6	58.9	103.4	63	25	112	200	171	3118	2948	2748
	2008	2	N3	360	9.3	3.87	131.5	87.7	223.1	108	55	169	332	256	3354	3098	2766
	2008	2	N4	480	9.3	7.77	218.8	116.5	343.1	175	85	225	485	341	3352	3011	2526
	2009	3	N0	0	5.6	0.48	4.5	1.3	6.2	5	1	2	9	0	2025	2025	2016
	2009	3	N1	120	6.5	0.96	13.8	30.1	44.8	29	10	56	95	85	2343	2258	2163
	2009	3	N2	240	7.6	1.93	42.6	58.9	103.4	63	25	112	200	171	2723	2553	2352
	2009	3	N3	360	7.1	3.87	131.5	87.7	223.1	108	55	169	332	256	2563	2308	1976
	2009	3	N4	480	7.8	7.77	218.8	116.5	343.1	175	85	225	485	341	2792	2451	1966
	2009	4	N0	0	7.1	0.48	4.5	1.3	6.2	5	1	2	9	0	2568	2568	2558
	2009	4	N1	120	8.2	0.96	13.8	30.1	44.8	29	10	56	95	85	2956	2871	2776

	2009	4	N2	240	9.2	1.93	42.6	58.9	103.4	63	25	112	200	171	3311	3141	2940
	2009	4	N3	360	9.6	3.87	131.5	87.7	223.1	108	55	169	332	256	3451	3195	2863
	2009	4	N4	480	9.1	7.77	218.8	116.5	343.1	175	85	225	485	341	3283	2942	2456
	2009	5	N0	0	7.7	0.48	4.5	1.3	6.2	5	1	2	9	0	2761	2761	2751
	2009	5	N1	120	8.8	0.96	13.8	30.1	44.8	29	10	56	95	85	3177	3092	2997
	2009	5	N2	240	9.4	1.93	42.6	58.9	103.4	63	25	112	200	171	3374	3204	3003
	2009	5	N3	360	9.5	3.87	131.5	87.7	223.1	108	55	169	332	256	3413	3157	2825
	2009	5	N4	480	9.0	7.77	218.8	116.5	343.1	175	85	225	485	341	3225	2884	2398
Zhengzhou	2009	1	N0	0	6.1	0.48	4.5	1.3	6.2	5	1	2	9	0	2198	2198	2189
	2009	1	N1	120	7.5	0.96	13.8	30.1	44.8	29	10	56	95	85	2691	2606	2511
	2009	1	N2	240	7.9	1.93	42.6	58.9	103.4	63	25	112	200	171	2835	2664	2464
	2009	1	N3	360	7.3	3.87	131.5	87.7	223.1	108	55	169	332	256	2609	2353	2021
	2009	1	N4	480	7.5	7.77	218.8	116.5	343.1	175	85	225	485	341	2691	2350	1864
	2009	2	N0	0	6.1	0.48	4.5	1.3	6.2	5	1	2	9	0	2185	2185	2175
	2009	2	N1	120	6.7	0.96	13.8	30.1	44.8	29	10	56	95	85	2404	2318	2224
	2009	2	N2	240	7.0	1.93	42.6	58.9	103.4	63	25	112	200	171	2498	2328	2128
	2009	2	N3	360	6.9	3.87	131.5	87.7	223.1	108	55	169	332	256	2474	2218	1886
	2009	2	N4	480	6.7	7.77	218.8	116.5	343.1	175	85	225	485	341	2396	2055	1570
	2009	3	N0	0	6.1	0.48	4.5	1.3	6.2	5	1	2	9	0	2196	2196	2187
	2009	3	N1	120	7.3	0.96	13.8	30.1	44.8	29	10	56	95	85	2619	2534	2439
	2009	3	N2	240	7.7	1.93	42.6	58.9	103.4	63	25	112	200	171	2783	2612	2412

	2009	3	N3	360	7.6	3.87	131.5	87.7	223.1	108	55	169	332	256	2737	2482	2149
	2009	3	N4	480	7.4	7.77	218.8	116.5	343.1	175	85	225	485	341	2661	2320	1834
Zhoukou	2008	1	N0	0	6.8	0.48	4.5	1.3	6.2	5	1	2	9	0	2458	2458	2448
	2008	1	N1	60	7.1	0.68	7.8	15.7	24.2	14	5	28	47	43	2539	2496	2449
	2008	1	N2	120	8.5	0.96	13.8	30.1	44.8	29	10	56	95	85	3049	2964	2869
	2008	1	N3	180	9.1	1.36	24.2	44.5	70.1	45	16	84	146	128	3269	3141	2995
	2008	1	N4	240	8.3	1.93	42.6	58.9	103.4	63	25	112	200	171	2966	2796	2596
	2008	2	N0	0	6.3	0.48	4.5	1.3	6.2	5	1	2	9	0	2249	2249	2240
	2008	2	N1	120	8.5	0.96	13.8	30.1	44.8	29	10	56	95	85	3069	2984	2889
	2008	2	N2	240	8.8	1.93	42.6	58.9	103.4	63	25	112	200	171	3177	3006	2806
	2008	2	N3	360	8.6	3.87	131.5	87.7	223.1	108	55	169	332	256	3094	2838	2506
	2008	2	N4	480	8.7	7.77	218.8	116.5	343.1	175	85	225	485	341	3110	2768	2283
	2008	3	N0	0	6.0	0.48	4.5	1.3	6.2	5	1	2	9	0	2153	2153	2144
	2008	3	N1	120	8.8	0.96	13.8	30.1	44.8	29	10	56	95	85	3159	3074	2979
	2008	3	N2	240	9.0	1.93	42.6	58.9	103.4	63	25	112	200	171	3241	3071	2870
	2008	3	N3	360	8.5	3.87	131.5	87.7	223.1	108	55	169	332	256	3070	2814	2482
	2008	3	N4	480	8.8	7.77	218.8	116.5	343.1	175	85	225	485	341	3147	2806	2321
	2008	4	N0	0	6.8	0.48	4.5	1.3	6.2	5	1	2	9	0	2434	2434	2425
	2008	4	N1	120	8.6	0.96	13.8	30.1	44.8	29	10	56	95	85	3083	2997	2902
	2008	4	N2	240	8.4	1.93	42.6	58.9	103.4	63	25	112	200	171	3005	2834	2634
	2008	4	N3	360	8.3	3.87	131.5	87.7	223.1	108	55	169	332	256	2971	2715	2383

2008	4	N4	480	8.4	7.77	218.8	116.5	343.1	175	85	225	485	341	3028	2687	2201
2008	5	N0	0	7.5	0.48	4.5	1.3	6.2	5	1	2	9	0	2690	2690	2681
2008	5	N1	120	8.2	0.96	13.8	30.1	44.8	29	10	56	95	85	2960	2875	2780
2008	5	N2	240	8.3	1.93	42.6	58.9	103.4	63	25	112	200	171	2972	2802	2602
2008	5	N3	360	8.3	3.87	131.5	87.7	223.1	108	55	169	332	256	2989	2733	2401
2008	5	N4	480	8.2	7.77	218.8	116.5	343.1	175	85	225	485	341	2933	2592	2106
2009	6	N0	0	4.6	0.48	4.5	1.3	6.2	5	1	2	9	0	1667	1667	1657
2009	6	N1	120	5.9	0.96	13.8	30.1	44.8	29	10	56	95	85	2127	2042	1947
2009	6	N2	240	7.0	1.93	42.6	58.9	103.4	63	25	112	200	171	2510	2340	2140
2009	6	N3	360	6.5	3.87	131.5	87.7	223.1	108	55	169	332	256	2348	2093	1761
2009	6	N4	480	6.2	7.77	218.8	116.5	343.1	175	85	225	485	341	2211	1870	1384
2009	7	N0	0	4.1	0.48	4.5	1.3	6.2	5	1	2	9	0	1488	1488	1478
2009	7	N1	120	5.5	0.96	13.8	30.1	44.8	29	10	56	95	85	1989	1904	1809
2009	7	N2	240	6.5	1.93	42.6	58.9	103.4	63	25	112	200	171	2333	2162	1962
2009	7	N3	360	6.2	3.87	131.5	87.7	223.1	108	55	169	332	256	2225	1969	1637
2009	7	N4	480	6.0	7.77	218.8	116.5	343.1	175	85	225	485	341	2162	1821	1335
2009	8	N0	0	4.4	0.48	4.5	1.3	6.2	5	1	2	9	0	1581	1581	1572
2009	8	N1	120	6.0	0.96	13.8	30.1	44.8	29	10	56	95	85	2164	2079	1984
2009	8	N2	240	6.5	1.93	42.6	58.9	103.4	63	25	112	200	171	2323	2153	1953
2009	8	N3	360	6.3	3.87	131.5	87.7	223.1	108	55	169	332	256	2260	2004	1672
2009	8	N4	480	6.2	7.77	218.8	116.5	343.1	175	85	225	485	341	2246	1905	1420

	2009	9	N0	0	4.2	0.48	4.5	1.3	6.2	5	1	2	9	0	1521	1521	1512
	2009	9	N1	120	6.4	0.96	13.8	30.1	44.8	29	10	56	95	85	2302	2217	2122
	2009	9	N2	240	6.9	1.93	42.6	58.9	103.4	63	25	112	200	171	2483	2313	2113
	2009	9	N3	360	6.7	3.87	131.5	87.7	223.1	108	55	169	332	256	2403	2147	1815
	2009	9	N4	480	6.6	7.77	218.8	116.5	343.1	175	85	225	485	341	2372	2031	1546
	2009	10	N0	0	8.6	0.48	4.5	1.3	6.2	5	1	2	9	0	3106	3106	3097
	2009	10	N1	120	9.0	0.96	13.8	30.1	44.8	29	10	56	95	85	3238	3152	3058
	2009	10	N2	240	9.8	1.93	42.6	58.9	103.4	63	25	112	200	171	3526	3356	3156
	2009	10	N3	360	10.2	3.87	131.5	87.7	223.1	108	55	169	332	256	3674	3418	3086
	2009	10	N4	480	9.8	7.77	218.8	116.5	343.1	175	85	225	485	341	3528	3187	2701
Zhumadian	2008	1	N0	0	10.3	0.48	4.5	1.3	6.2	5	1	2	9	0	3706	3706	3697
	2008	1	N1	105	10.7	0.88	12.0	26.5	39.3	25	8	49	83	75	3847	3772	3689
	2008	1	N2	210	11.0	1.62	32.1	51.7	85.4	54	20	98	172	149	3943	3794	3622
	2008	1	N3	315	10.9	2.98	86.2	76.9	166.0	90	41	147	278	224	3904	3680	3402
	2008	1	N4	420	10.6	5.49	231.2	102.1	338.8	138	85	197	420	298	3815	3517	3097
	2008	2	N0	0	3.6	0.48	4.5	1.3	6.2	5	1	2	9	0	1283	1283	1274
	2008	2	N1	120	6.0	0.96	13.8	30.1	44.8	29	10	56	95	85	2168	2083	1988
	2008	2	N2	240	7.4	1.93	42.6	58.9	103.4	63	25	112	200	171	2664	2494	2294
	2008	2	N3	360	7.5	3.87	131.5	87.7	223.1	108	55	169	332	256	2709	2453	2121
	2008	2	N4	480	6.8	7.77	218.8	116.5	343.1	175	85	225	485	341	2445	2104	1619
	2008	3	N0	0	5.8	0.48	4.5	1.3	6.2	5	1	2	9	0	2098	2098	2089

2008	3	N1	120	7.6	0.96	13.8	30.1	44.8	29	10	56	95	85	2733	2648	2553
2008	3	N2	240	9.1	1.93	42.6	58.9	103.4	63	25	112	200	171	3255	3085	2884
2008	3	N3	360	9.1	3.87	131.5	87.7	223.1	108	55	169	332	256	3282	3026	2694
2008	3	N4	480	7.6	7.77	218.8	116.5	343.1	175	85	225	485	341	2742	2401	1916
2008	4	N0	0	5.1	0.48	4.5	1.3	6.2	5	1	2	9	0	1845	1845	1836
2008	4	N1	120	6.7	0.96	13.8	30.1	44.8	29	10	56	95	85	2400	2315	2220
2008	4	N2	240	9.3	1.93	42.6	58.9	103.4	63	25	112	200	171	3335	3164	2964
2008	4	N3	360	9.0	3.87	131.5	87.7	223.1	108	55	169	332	256	3243	2987	2655
2008	4	N4	480	7.6	7.77	218.8	116.5	343.1	175	85	225	485	341	2734	2393	1908
2008	5	N0	0	4.6	0.48	4.5	1.3	6.2	5	1	2	9	0	1666	1666	1657
2008	5	N1	120	6.1	0.96	13.8	30.1	44.8	29	10	56	95	85	2196	2111	2016
2008	5	N2	240	7.5	1.93	42.6	58.9	103.4	63	25	112	200	171	2703	2533	2333
2008	5	N3	360	7.7	3.87	131.5	87.7	223.1	108	55	169	332	256	2768	2512	2180
2008	5	N4	480	7.4	7.77	218.8	116.5	343.1	175	85	225	485	341	2674	2333	1848
2008	6	N0	0	4.3	0.48	4.5	1.3	6.2	5	1	2	9	0	1563	1563	1554
2008	6	N1	120	6.6	0.96	13.8	30.1	44.8	29	10	56	95	85	2355	2270	2175
2008	6	N2	240	8.1	1.93	42.6	58.9	103.4	63	25	112	200	171	2907	2736	2536
2008	6	N3	360	8.1	3.87	131.5	87.7	223.1	108	55	169	332	256	2926	2671	2338
2008	6	N4	480	7.4	7.77	218.8	116.5	343.1	175	85	225	485	341	2671	2330	1845
2009	7	N0	0	7.5	0.48	4.5	1.3	6.2	5	1	2	9	0	2679	2679	2669
2009	7	N1	120	8.7	0.96	13.8	30.1	44.8	29	10	56	95	85	3128	3043	2948

2009	7	N2	240	9.1	1.93	42.6	58.9	103.4	63	25	112	200	171	3263	3092	2892
2009	7	N3	360	8.6	3.87	131.5	87.7	223.1	108	55	169	332	256	3101	2845	2513
2009	7	N4	480	7.6	7.77	218.8	116.5	343.1	175	85	225	485	341	2748	2407	1922

Supplementary Table 2. N rate (kg N/ha), control yield (Mg/ha), grain yield (Mg/ha), Nr losses intensity (kg N/Mg grain yield) of fertilizer N use, environmental costs of N fertilizer production and use, economic benefit and net benefit ($/ha) with agronomically, economically and agronomically optimal N rate over 91 sites in 12 counties in Henan province for maize production in China from 2008 to 2009. F, C and R indicate fluvo aquic soil, cinnamon soil and red clay, respectively.

City	Year	Site	Soil type	Control yield	N rate	Grain yield	Economic benefit	Net benefit	Environmental costs				Nr losses intensity			
									Cgw	Ceu	Cacid	Total	N_2O	Leaching	NH_3	Total
Agronomically optimal N																
Hebei	2008	1	F	9.4	234.5	10.0	45.9	-151.0	66.7	25.3	112.2	204.2	0.2	4.0	5.8	10.0
	2008	2	F	6.5	283.8	8.6	561.9	313.8	83.3	34.6	135.3	253.1	0.3	7.5	8.1	15.8
	2008	3	F	8.1	320.2	9.5	268.2	-19.9	96.9	43.7	152.4	293.0	0.3	9.6	8.3	18.2
	2008	4	F	9.1	351.2	10.8	346.6	23.1	109.7	53.5	166.8	330.1	0.3	11.2	7.9	19.5
	2009	5	F	6.7	319.0	8.3	353.6	67.0	96.4	43.3	151.8	291.5	0.4	10.7	9.3	20.4
	2009	6	F	8.8	306.7	10.4	358.0	85.0	91.7	40.0	146.0	277.7	0.3	7.7	7.2	15.2
	2009	7	F	8.0	310.0	10.0	480.7	204.3	93.0	40.8	147.6	281.4	0.3	8.2	7.6	16.1

	2009	8	F	7.7	318.3	10.1	622.7	336.8	96.2	43.1	151.4	290.7	0.3	8.8	7.7	16.9
	2009	9	F	7.5	305.0	9.9	646.4	375.2	91.1	39.6	145.2	275.9	0.3	7.9	7.5	15.8
	2009	10	F	7.3	332.2	9.7	607.3	305.7	101.7	47.2	158.0	306.9	0.3	10.5	8.4	19.2
	2009	11	F	7.1	300.3	9.6	662.4	396.4	89.3	38.4	143.0	270.7	0.3	7.8	7.7	15.8
Jiaozuo	2008	1	F	9.3	202.5	9.9	79.8	-85.6	56.9	20.6	97.2	174.8	0.2	3.0	5.0	8.2
	2008	2	F	9.7	295.2	11.0	273.3	12.9	87.4	37.2	140.6	265.2	0.2	6.5	6.5	13.2
	2008	3	F	8.0	277.9	11.3	985.8	744.2	81.2	33.3	132.5	247.0	0.2	5.4	6.0	11.6
	2008	4	F	10.8	242.0	12.0	237.4	34.8	69.1	26.5	115.7	211.4	0.2	3.6	5.0	8.8
	2008	5	F	8.1	257.4	9.8	501.4	276.7	74.2	29.3	122.9	226.4	0.2	5.1	6.5	11.8
	2008	6	F	7.7	280.1	10.2	685.4	444.4	82.0	33.8	133.6	249.3	0.2	6.1	6.7	13.0
	2009	7	F	7.8	262.7	8.7	142.0	-83.7	75.9	30.2	125.4	231.6	0.3	6.0	7.4	13.7
	2009	8	F	8.3	206.5	8.8	56.4	-113.0	58.1	21.1	99.1	178.4	0.2	3.5	5.8	9.5
	2009	9	F	8.5	219.0	9.4	167.8	-13.6	61.9	22.9	105.0	189.8	0.2	3.7	5.7	9.6
	2009	10	F	7.1	252.0	8.7	387.9	173.3	72.4	28.3	120.4	221.0	0.2	5.5	7.1	12.8
	2009	11	C	3.2	249.7	5.9	787.9	577.6	71.6	27.9	119.3	218.8	0.3	7.9	10.4	18.7
	2009	12	F	3.4	248.2	6.7	1017.9	802.9	71.1	27.6	118.7	217.4	0.3	6.9	9.1	16.3

Kaifeng	2008	1	F	6.0	301.4	9.0	862.4	595.3	89.7	64.9	143.5	298.1	0.3	19.6	8.2	28.1
	2008	2	F	7.9	271.4	9.5	350.9	123.4	78.9	31.9	129.5	240.4	0.2	6.0	7.0	13.3
	2008	3	F	6.4	306.8	8.6	568.4	295.2	91.8	40.0	146.1	277.9	0.3	9.3	8.7	18.3
	2008	4	F	7.7	291.2	9.0	263.2	7.2	85.9	36.2	138.8	260.9	0.3	7.6	7.9	15.8
	2008	5	F	7.0	252.0	8.0	170.3	-42.4	72.4	28.3	120.4	221.1	0.3	6.0	7.7	14.0
	2008	6	F	7.3	220.0	8.4	221.4	40.0	62.2	23.1	105.5	190.8	0.2	4.2	6.5	10.9
	2008	7	R	5.8	292.4	7.7	469.3	215.5	86.4	36.5	139.3	262.3	0.3	9.1	9.3	18.8
	2009	8	F	8.4	233.0	9.2	111.8	-82.1	66.2	25.1	111.5	202.8	0.2	4.3	6.2	10.8
	2009	9	F	7.2	253.6	8.6	351.4	137.2	72.9	28.6	121.2	222.7	0.2	5.6	7.2	13.1
	2009	10	F	8.2	241.8	9.4	275.1	72.6	69.1	26.5	115.7	211.2	0.2	4.6	6.3	11.1
Luoyang	2008	1	F	7.5	344.6	9.7	566.4	250.5	106.9	51.2	163.7	321.9	0.4	11.7	8.6	20.7
	2008	2	C	6.7	330.1	8.4	382.2	82.9	100.9	46.5	157.0	304.4	0.4	11.8	9.6	21.8
	2008	3	C	6.9	326.7	8.8	425.9	130.6	99.5	45.5	155.4	300.4	0.4	11.0	9.1	20.4
	2008	4	F	7.6	345.8	10.0	612.6	295.4	107.4	51.6	164.3	323.3	0.4	11.6	8.5	20.4
	2008	5	C	5.2	314.9	6.7	333.2	51.1	94.9	42.2	149.9	286.9	0.4	12.8	11.5	24.7
	2009	6	C	6.8	295.2	8.2	276.0	15.5	87.4	37.2	140.7	265.3	0.3	8.8	8.8	17.9

	2009	7	C	5.5	286.9	6.6	182.3	-69.2	84.4	35.2	136.8	256.4	0.4	10.0	10.6	21.0
	2009	8	C	4.6	310.2	6.4	428.7	151.8	93.0	40.9	147.7	281.6	0.5	12.9	11.9	25.3
	2009	9	C	7.0	281.6	8.6	375.1	129.3	82.5	34.1	134.3	250.9	0.3	7.3	8.0	15.5
	2009	10	C	6.9	288.4	8.5	396.0	142.9	84.9	35.6	137.5	258.0	0.3	7.9	8.3	16.4
	2009	11	F	5.6	260.9	6.8	228.5	4.6	75.4	29.9	124.6	229.9	0.3	7.7	9.4	17.4
	2009	12	C	4.7	240.5	5.8	241.9	38.9	68.6	26.3	115.0	210.0	0.3	7.3	10.1	17.7
	2009	13	C	7.9	183.4	8.9	230.4	81.3	51.4	18.1	88.3	157.8	0.2	2.8	5.1	8.0
	2009	14	C	7.8	202.1	8.4	46.2	-120.4	56.8	20.6	97.1	174.4	0.2	3.6	6.0	9.7
	2009	15	C	8.9	208.8	9.7	152.6	-20.4	58.8	21.5	100.2	180.4	0.2	3.3	5.3	8.7
	2009	16	C	7.8	185.7	8.8	230.0	78.7	52.0	18.4	89.4	159.9	0.2	2.9	5.2	8.3
	2009	17	R	8.4	205.7	10.1	484.8	319.0	57.9	21.0	98.7	177.7	0.2	3.0	5.0	8.2
	2009	18	R	8.6	172.6	9.1	61.1	-75.2	48.3	16.8	83.2	148.4	0.1	2.5	4.7	7.3
Nanyang	2009	1	R	6.3	268.1	7.5	252.7	21.3	77.8	31.3	127.9	237.0	0.3	7.4	8.7	16.4
	2009	2	R	6.2	265.3	6.9	56.0	-172.4	76.8	30.7	126.6	234.2	0.3	7.8	9.4	17.5
	2009	3	R	5.4	310.7	7.6	536.5	259.1	93.2	41.0	147.9	282.2	0.4	10.9	10.0	21.4
Pingdingshan	2009	1	C	3.7	298.9	5.7	526.1	261.6	88.8	38.1	142.4	269.2	0.5	12.9	12.7	26.1

	2009	2	C	3.8	299.0	5.9	544.7	280.1	88.8	38.1	142.4	269.4	0.5	12.5	12.4	25.4
	2009	3	F	4.8	298.7	7.5	744.5	480.3	88.7	38.0	142.3	268.9	0.4	9.9	9.8	20.1
	2009	4	C	3.2	298.6	4.9	417.5	153.4	88.6	38.0	142.2	268.8	0.6	15.0	14.8	30.4
Shanmenxia	2009	1	C	4.5	303.9	6.6	568.6	298.7	90.6	39.3	144.7	274.6	0.4	11.7	11.2	23.3
	2009	2	R	5.6	285.5	6.9	267.9	18.0	83.9	34.9	136.1	254.9	0.4	9.4	10.1	19.9
	2009	3	R	4.3	304.9	6.4	573.1	302.1	91.0	39.5	145.2	275.7	0.4	12.2	11.6	24.2
	2009	4	C	6.1	306.1	7.2	174.5	-88.5	91.5	39.8	145.7	277.0	0.4	11.1	10.4	21.9
Shangqiu	2009	1	F	6.8	339.7	8.7	451.9	141.7	104.9	49.6	161.5	316.0	0.4	12.5	9.5	22.5
	2009	2	F	5.9	288.3	8.8	852.4	599.5	84.9	35.6	137.4	257.8	0.3	7.6	8.0	15.9
	2009	3	F	6.7	364.7	9.2	659.1	319.7	115.7	58.6	173.2	347.5	0.4	14.9	9.7	25.0
	2009	4	F	6.3	329.4	9.0	717.5	419.1	100.6	46.3	156.6	303.6	0.4	11.0	9.0	20.3
Xinxiang	2008	1	F	6.8	227.9	7.6	117.7	-72.6	64.7	24.3	109.1	198.0	0.2	5.0	7.4	12.6
	2008	2	F	6.4	413.6	9.4	765.9	366.7	139.9	82.6	196.1	418.5	0.6	23.2	10.7	34.6
	2009	3	C	5.6	443.0	7.6	398.2	-38.3	156.6	102.4	209.8	468.8	0.8	37.6	14.1	52.5
	2009	4	F	7.1	364.4	9.5	565.8	226.6	115.6	58.5	173.1	347.2	0.4	14.5	9.4	24.3
	2009	5	C	7.7	311.5	9.5	437.3	159.0	93.5	41.2	148.3	283.0	0.3	8.8	8.0	17.1

Zhengzhou	2009	1	C	6.1	305.3	7.8	396.8	125.4	91.2	39.6	145.4	276.2	0.4	10.1	9.5	20.0
	2009	2	C	6.1	299.7	7.0	109.5	-155.8	89.1	38.2	142.8	270.1	0.4	10.7	10.5	21.6
	2009	3	C	6.1	313.7	7.8	390.9	110.1	94.4	41.8	149.3	285.5	0.4	10.9	9.8	21.1
Zhoukou	2008	1	F	6.8	197.2	8.6	496.9	334.0	55.4	19.9	94.7	170.0	0.2	3.3	5.6	9.1
	2008	2	F	6.3	322.2	9.1	788.5	498.2	97.7	44.2	153.3	295.2	0.3	10.1	8.6	19.1
	2008	3	F	6.0	316.1	9.3	959.6	676.2	95.3	42.5	150.4	288.2	0.3	9.4	8.3	18.0
	2008	4	F	6.8	319.6	8.7	454.5	167.1	96.7	43.5	152.1	292.2	0.4	10.4	9.0	19.7
	2008	5	F	7.5	307.5	8.4	110.0	-163.9	92.0	40.2	146.4	278.6	0.3	9.6	8.9	18.8
	2009	6	F	4.6	302.8	6.8	571.9	303.1	90.2	70.5	144.2	305.0	0.4	28.9	10.8	40.2
	2009	7	F	4.1	324.0	6.5	608.4	316.1	98.4	44.7	154.1	297.3	0.5	14.5	12.2	27.2
	2009	8	F	4.4	324.2	6.6	568.4	275.8	98.5	44.8	154.2	297.6	0.5	14.2	12.0	26.7
	2009	9	F	4.2	321.0	7.1	805.5	516.5	97.2	43.9	152.7	293.8	0.4	12.8	11.0	24.2
	2009	10	F	8.6	404.3	10.0	202.4	-185.1	134.9	77.2	191.7	403.9	0.5	20.0	9.9	30.3
Zhumadian	2008	1	F	10.3	243.8	10.9	53.9	-150.3	69.7	26.8	116.6	213.1	0.2	4.0	5.5	9.7
	2008	2	R	3.6	327.5	7.7	1236.2	939.8	99.9	45.8	155.8	301.4	0.4	12.7	10.4	23.5
	2008	3	R	5.8	293.1	9.1	952.0	693.9	86.6	36.7	139.7	263.0	0.3	7.7	7.9	15.9

	2008	4	R	5.1	308.9	9.0	1157.3	881.9	92.5	40.6	147.0	280.1	0.3	9.1	8.4	17.8
	2008	5	F	4.6	369.8	7.7	851.7	506.2	118.1	60.7	175.6	354.3	0.5	18.7	11.7	30.9
	2008	6	C	4.3	329.1	8.2	1164.6	866.5	100.5	64.8	156.5	321.8	0.4	20.6	9.7	30.7
	2009	7	F	7.5	245.8	9.1	400.8	192.5	70.4	27.2	117.5	215.1	0.2	5.0	6.7	11.8
							Economically optimal N									
Hebei	2008	1	F	9.4	142.3	9.9	79.0	-31.3	40.1	13.5	69.1	122.7	0.1	1.7	3.6	5.4
	2008	2	F	6.5	246.1	8.6	575.3	366.7	70.5	27.2	117.6	215.3	0.2	5.3	7.0	12.5
	2008	3	F	8.1	247.4	9.4	293.7	83.8	70.9	27.5	118.2	216.6	0.2	4.9	6.5	11.5
	2008	4	F	9.1	278.4	10.7	372.0	129.7	81.4	33.4	132.8	247.6	0.2	5.7	6.4	12.3
	2009	5	F	6.7	255.1	8.3	377.3	159.5	73.4	28.8	121.8	224.1	0.3	5.9	7.5	13.7
	2009	6	F	8.8	249.0	10.3	378.3	166.7	71.4	27.7	119.0	218.2	0.2	4.5	5.9	10.6
	2009	7	F	8.0	261.2	9.9	498.1	274.0	75.5	30.0	124.7	230.1	0.2	5.2	6.4	11.9
	2009	8	F	7.7	277.0	10.0	636.9	396.0	80.9	33.1	132.1	246.1	0.2	6.0	6.8	13.0
	2009	9	F	7.5	267.7	9.8	659.2	428.2	77.6	31.2	127.8	236.6	0.2	5.6	6.7	12.5
	2009	10	F	7.3	286.4	9.6	623.3	372.5	84.2	35.1	136.5	255.8	0.3	6.8	7.3	14.4
	2009	11	F	7.1	263.8	9.5	675.3	448.3	76.3	30.5	126.0	232.8	0.2	5.6	6.8	12.6

Jiaozuo	2008	1	F	9.3	137.7	9.9	102.5	-3.9	38.8	13.1	66.9	118.8	0.1	1.6	3.5	5.2
	2008	2	F	9.7	230.3	11.0	296.9	104.3	65.4	24.6	110.2	200.3	0.2	3.5	5.2	8.9
	2008	3	F	8.0	254.9	11.3	993.9	776.3	73.3	28.8	121.8	223.9	0.2	4.3	5.5	10.0
	2008	4	F	10.8	190.1	11.9	256.6	103.2	53.3	19.0	91.4	163.7	0.1	2.2	3.9	6.3
	2008	5	F	8.1	238.1	9.8	504.7	300.1	67.9	25.9	113.9	207.7	0.2	4.3	6.0	10.5
	2008	6	F	7.7	248.3	10.2	696.8	487.8	71.2	27.6	118.7	217.5	0.2	4.5	6.0	10.7
	2009	7	F	7.8	187.6	8.6	169.0	17.6	52.6	18.7	90.3	161.5	0.2	3.0	5.4	8.5
	2009	8	F	8.3	131.7	8.7	83.3	-17.8	37.3	12.4	64.1	113.8	0.1	1.8	3.8	5.6
	2009	9	F	8.5	166.7	9.4	186.2	54.1	46.7	16.2	80.5	143.3	0.1	2.3	4.4	6.8
	2009	10	F	7.1	212.5	8.7	401.8	226.7	59.9	22.0	101.9	183.8	0.2	3.8	6.0	10.0
	2009	11	C	3.2	226.6	5.9	796.1	608.4	64.3	24.1	108.5	196.9	0.3	6.4	9.5	16.2
	2009	12	F	3.4	230.3	6.7	1024.1	827.4	65.4	24.7	110.3	200.4	0.3	5.8	8.5	14.6
Kaifeng	2008	1	F	6.0	271.9	9.0	872.6	637.2	79.1	32.1	129.8	240.9	0.3	6.4	7.4	14.1
	2008	2	F	7.9	221.9	9.4	369.2	189.8	62.8	23.4	106.3	192.5	0.2	3.8	5.8	9.8
	2008	3	F	6.4	263.7	8.6	584.0	357.3	76.3	30.4	125.9	232.6	0.3	6.2	7.5	14.0
	2008	4	F	7.7	226.3	8.9	286.8	98.1	64.2	24.0	108.4	196.6	0.2	4.2	6.2	10.6

	2008	5	F	7.0	187.4	7.9	193.2	42.3	52.5	18.6	90.2	161.4	0.2	3.3	5.9	9.3
	2008	6	F	7.3	174.5	8.3	237.6	98.4	48.9	17.1	84.1	150.1	0.2	2.8	5.2	8.1
	2008	7	R	5.8	247.8	7.6	485.0	276.6	71.0	27.5	118.4	217.0	0.3	6.0	8.0	14.3
	2009	8	F	8.4	163.5	9.1	136.4	7.1	45.8	15.8	79.0	140.6	0.1	2.3	4.4	6.9
	2009	9	F	7.2	211.3	8.6	366.1	193.0	59.6	21.8	101.4	182.7	0.2	3.8	6.1	10.0
	2009	10	F	8.2	195.8	9.4	291.3	132.7	55.0	19.7	94.1	168.7	0.2	3.0	5.2	8.3
Luoyang	2008	1	F	7.5	291.4	9.7	585.9	329.6	86.0	36.3	138.9	261.1	0.3	7.1	7.4	14.7
	2008	2	C	6.7	266.6	8.3	405.1	175.3	77.3	31.0	127.3	235.5	0.3	6.6	7.8	14.7
	2008	3	C	6.9	268.5	8.7	446.9	215.1	77.9	31.4	128.1	237.4	0.3	6.4	7.6	14.2
	2008	4	F	7.6	295.9	9.9	630.5	369.3	87.7	37.3	141.0	266.0	0.3	7.3	7.3	14.8
	2008	5	C	5.2	251.9	6.7	355.4	140.9	72.4	28.3	120.4	221.0	0.3	7.2	9.3	16.8
	2009	6	C	6.8	232.6	8.1	297.5	102.6	66.1	25.0	111.3	202.5	0.2	4.9	7.1	12.2
	2009	7	C	5.5	209.6	6.5	210.9	38.6	59.1	21.6	100.6	181.2	0.2	4.9	7.9	13.1
	2009	8	C	4.6	258.2	6.3	446.8	225.7	74.5	29.4	123.3	227.2	0.3	8.0	10.0	18.3
	2009	9	C	7.0	233.3	8.6	391.9	196.2	66.4	25.1	111.7	203.1	0.2	4.6	6.7	11.5
	2009	10	C	6.9	238.2	8.5	414.4	213.7	67.9	25.9	114.0	207.8	0.2	4.9	6.9	12.0

	2009	11	F	5.6	203.4	6.7	248.3	81.9	57.2	20.7	97.7	175.6	0.2	4.5	7.5	12.2
	2009	12	C	4.7	191.1	5.8	259.2	104.6	53.6	19.1	91.9	164.6	0.3	4.6	8.1	13.0
	2009	13	C	7.9	150.4	8.9	242.1	122.7	42.2	14.4	72.9	129.5	0.1	2.1	4.2	6.4
	2009	14	C	7.8	125.4	8.3	73.9	-23.7	35.6	11.8	61.1	108.6	0.1	1.8	3.8	5.7
	2009	15	C	8.9	157.3	9.7	170.8	45.3	44.1	15.1	76.1	135.3	0.1	2.0	4.0	6.2
	2009	16	C	7.8	151.8	8.8	242.0	121.4	42.6	14.5	73.5	130.6	0.1	2.1	4.3	6.5
	2009	17	R	8.4	181.4	10.1	493.7	349.6	50.8	17.9	87.4	156.1	0.1	2.4	4.4	7.0
	2009	18	R	8.6	114.8	9.0	81.8	-5.6	32.9	10.8	56.2	99.9	0.1	1.5	3.2	4.7
Nanyang	2009	1	R	6.3	210.1	7.5	273.6	100.8	59.2	21.6	100.8	181.6	0.2	4.3	6.9	11.4
	2009	2	R	6.2	162.8	6.8	92.7	-35.8	45.6	15.7	78.6	140.0	0.2	3.0	5.9	9.1
	2009	3	R	5.4	264.6	7.5	553.3	325.5	76.6	30.6	126.3	233.6	0.3	7.1	8.6	16.1
Pingdingshan	2009	1	C	3.7	256.8	5.7	540.7	321.1	74.0	29.1	122.6	225.8	0.4	8.8	11.1	20.2
	2009	2	C	3.8	256.7	5.9	560.0	340.5	73.9	29.1	122.6	225.7	0.4	8.5	10.7	19.6
	2009	3	F	4.8	265.8	7.4	756.0	527.0	77.0	30.8	126.9	234.7	0.3	7.3	8.8	16.4
	2009	4	C	3.2	247.7	4.9	435.8	225.5	71.0	27.5	118.4	216.9	0.4	9.4	12.5	22.3
Shanmenxia	2009	1	C	4.5	263.3	6.6	582.5	356.1	76.2	30.4	125.7	232.3	0.3	8.0	9.8	18.1

	2009	2	R	5.6	223.6	6.9	290.1	104.0	63.3	23.6	107.1	194.1	0.3	5.3	8.0	13.6
	2009	3	R	4.3	264.3	6.4	586.9	359.5	76.5	30.6	126.2	233.3	0.3	8.4	10.1	18.8
	2009	4	C	6.1	219.3	7.1	206.8	29.8	62.0	23.0	105.1	190.1	0.2	5.0	7.6	12.8
Shangqiu	2009	1	F	6.8	280.7	8.6	472.8	228.0	82.2	33.9	133.9	249.9	0.3	7.2	8.0	15.5
	2009	2	F	5.9	259.6	8.8	862.9	640.3	74.9	29.7	124.0	228.6	0.2	5.8	7.2	13.3
	2009	3	F	6.7	313.3	9.2	677.3	397.0	94.2	41.7	149.1	285.1	0.3	9.3	8.4	17.9
	2009	4	F	6.3	289.9	8.9	731.1	476.4	85.5	35.9	138.1	259.5	0.3	7.6	7.9	15.8
Xinxiang	2008	1	F	6.8	161.8	7.5	141.3	13.7	45.3	15.6	78.2	139.1	0.2	2.7	5.3	8.2
	2008	2	F	6.4	358.6	9.3	784.3	452.1	113.0	56.3	170.3	339.6	0.4	13.9	9.4	23.7
	2009	3	C	5.6	343.0	7.5	435.2	121.2	106.2	50.7	163.0	319.9	0.5	14.9	11.1	26.4
	2009	4	F	7.1	305.4	9.4	587.7	316.1	91.2	39.7	145.4	276.3	0.3	8.4	7.9	16.6
	2009	5	C	7.7	259.0	9.5	456.0	234.2	74.7	29.5	123.7	227.9	0.2	5.4	6.7	12.3
Zhengzhou	2009	1	C	6.1	252.6	7.8	414.8	199.5	72.6	28.4	120.7	221.7	0.3	6.2	8.0	14.4
	2009	2	C	6.1	200.6	6.9	144.9	-18.8	56.4	20.3	96.4	173.1	0.2	4.3	7.2	11.7
	2009	3	C	6.1	257.3	7.8	410.6	190.4	74.2	29.2	122.9	226.3	0.3	6.5	8.1	14.9
Zhoukou	2008	1	F	6.8	175.4	8.6	504.7	361.3	49.1	17.2	84.6	150.9	0.2	2.7	5.1	7.9

	2008	2	F	6.3	284.7	9.1	802.4	553.4	83.6	34.8	135.7	254.1	0.3	7.1	7.7	15.1
	2008	3	F	6.0	286.7	9.2	969.8	718.6	84.3	35.2	136.7	256.2	0.3	7.1	7.6	15.0
	2008	4	F	6.8	265.9	8.6	473.8	244.7	77.1	30.9	126.9	234.9	0.3	6.3	7.6	14.1
	2008	5	F	7.5	204.8	8.3	146.8	-20.9	57.6	20.9	98.3	176.9	0.2	3.7	6.1	10.0
	2009	6	F	4.6	261.2	6.8	586.8	362.6	75.5	30.0	124.7	230.1	0.3	7.7	9.4	17.4
	2009	7	F	4.1	280.8	6.4	623.1	378.2	82.2	33.9	133.9	250.1	0.4	9.7	10.7	20.8
	2009	8	F	4.4	279.0	6.6	583.8	340.8	81.6	33.5	133.1	248.2	0.4	9.4	10.4	20.1
	2009	9	F	4.2	284.7	7.1	818.7	569.7	83.6	34.8	135.7	254.1	0.4	9.2	9.8	19.3
	2009	10	F	8.6	288.5	9.9	241.3	-11.8	85.0	35.6	137.5	258.0	0.3	6.8	7.1	14.2
Zhumadian	2008	1	F	10.3	151.0	10.8	86.6	-28.6	42.4	14.4	73.1	129.9	0.1	1.7	3.5	5.3
	2008	2	R	3.6	301.5	7.6	1245.5	978.1	89.8	38.7	143.6	272.0	0.4	9.9	9.7	20.0
	2008	3	R	5.8	266.0	9.0	962.0	732.8	77.1	30.9	127.0	234.9	0.2	6.0	7.2	13.5
	2008	4	R	5.1	284.5	8.9	1165.8	916.9	83.5	34.7	135.6	253.9	0.3	7.2	7.8	15.3
	2008	5	F	4.6	327.1	7.7	866.5	570.7	99.7	45.6	155.6	300.9	0.4	12.6	10.4	23.4
	2008	6	C	4.3	301.7	8.2	1174.3	906.8	89.8	38.7	143.7	272.3	0.3	9.3	9.0	18.6
	2009	7	F	7.5	207.8	9.0	414.6	244.0	58.5	21.3	99.7	179.6	0.2	3.5	5.7	9.3

Ecologically optimal N															
Hebei	2008	1	F	9.4	47.3	9.6	43.8	10.3	16.3	5.0	24.6	45.9	0.1	0.7	1.3	2.1
	2008	2	F	6.5	196.1	8.4	551.6	392.2	55.1	19.7	94.2	169.0	0.2	3.4	5.8	9.3
	2008	3	F	8.1	154.5	9.1	252.3	131.3	43.3	14.8	74.8	132.9	0.1	2.1	4.2	6.4
	2008	4	F	9.1	181.6	10.4	327.0	181.3	50.9	17.9	87.4	156.2	0.1	2.4	4.3	6.8
	2009	5	F	6.7	175.6	8.0	340.7	200.5	49.2	17.2	84.7	151.0	0.2	2.9	5.4	8.5
	2009	6	F	8.8	173.7	10.1	343.7	205.2	48.6	17.0	83.8	149.4	0.1	2.3	4.3	6.7
	2009	7	F	8.0	196.2	9.7	467.2	307.9	55.1	19.8	94.3	169.1	0.2	2.9	5.0	8.0
	2009	8	F	7.7	217.9	9.8	607.9	427.4	61.6	22.8	104.5	188.8	0.2	3.5	5.5	9.1
	2009	9	F	7.5	214.6	9.7	633.3	456.1	60.6	22.3	102.9	185.8	0.2	3.5	5.5	9.1
	2009	10	F	7.3	221.5	9.4	591.3	407.3	62.7	23.3	106.2	192.1	0.2	3.8	5.8	9.8
	2009	11	F	7.1	213.6	9.4	650.8	474.5	60.3	22.1	102.4	184.8	0.2	3.5	5.6	9.3
Jiaozuo	2008	1	F	9.3	66.6	9.7	75.1	27.0	20.9	6.6	33.6	61.1	0.1	0.9	1.8	2.7
	2008	2	F	9.7	151.1	10.7	261.8	143.8	42.4	14.4	73.2	130.0	0.1	1.7	3.5	5.3
	2008	3	F	8.0	222.6	11.2	978.0	793.0	63.0	23.5	106.7	193.1	0.2	3.2	4.9	8.3
	2008	4	F	10.8	130.3	11.7	231.2	130.8	36.9	12.3	63.4	112.6	0.1	1.3	2.8	4.2

	2008	5	F	8.1	184.7	9.6	479.3	327.5	51.8	18.3	88.9	159.0	0.1	2.6	4.7	7.5
	2008	6	F	7.7	206.7	10.0	677.2	508.4	58.2	21.2	99.2	178.6	0.2	3.1	5.1	8.3
	2009	7	F	7.8	102.4	8.4	134.1	57.6	29.7	9.7	50.3	89.7	0.1	1.4	3.1	4.6
	2009	8	F	8.3	53.5	8.5	53.9	15.8	17.8	5.5	27.5	50.8	0.1	0.9	1.7	2.6
	2009	9	F	8.5	105.3	9.2	160.9	82.0	30.5	9.9	51.7	92.1	0.1	1.3	2.9	4.3
	2009	10	F	7.1	161.8	8.5	379.0	251.3	45.3	15.6	78.2	139.1	0.1	2.4	4.7	7.3
	2009	11	C	3.2	196.7	5.8	782.2	622.8	55.2	19.8	94.5	169.6	0.3	4.9	8.4	13.6
	2009	12	F	3.4	205.0	6.6	1011.7	840.3	57.7	20.9	98.4	177.0	0.2	4.6	7.7	12.6
Kaifeng	2008	1	F	6.0	229.7	8.8	851.6	659.5	65.2	24.5	110.0	199.7	0.2	4.4	6.4	11.0
	2008	2	F	7.9	163.7	9.2	343.9	217.2	45.9	15.8	79.1	140.8	0.1	2.3	4.4	6.8
	2008	3	F	6.4	206.3	8.4	556.4	387.2	58.1	21.1	99.0	178.2	0.2	3.7	6.1	9.9
	2008	4	F	7.7	147.6	8.7	252.1	137.2	41.5	14.1	71.5	127.0	0.1	2.1	4.2	6.4
	2008	5	F	7.0	112.2	7.7	162.1	76.8	32.2	10.6	55.0	97.8	0.1	1.7	3.7	5.5
	2008	6	F	7.3	120.8	8.2	215.1	122.6	34.4	11.4	59.0	104.8	0.1	1.7	3.7	5.5
	2008	7	R	5.8	189.6	7.4	458.3	305.4	53.2	18.9	91.2	163.2	0.2	3.6	6.3	10.1
	2009	8	F	8.4	85.6	8.9	105.4	41.7	25.5	8.2	42.5	76.2	0.1	1.1	2.5	3.7

	2009	9	F	7.2	157.6	8.4	342.4	218.4	44.2	15.1	76.2	135.5	0.1	2.3	4.6	7.1
	2009	10	F	8.2	139.2	9.2	267.0	158.9	39.2	13.2	67.6	120.1	0.1	1.8	3.8	5.7
Luoyang	2008	1	F	7.5	220.1	9.4	550.8	368.2	62.2	23.1	105.5	190.8	0.2	3.7	5.7	9.6
	2008	2	C	6.7	184.7	8.1	366.9	218.3	51.7	18.3	88.9	158.9	0.2	3.1	5.7	9.0
	2008	3	C	6.9	192.3	8.4	410.9	255.1	53.9	19.3	92.5	165.7	0.2	3.2	5.6	9.0
	2008	4	F	7.6	226.9	9.7	596.3	406.9	64.4	24.1	108.7	197.2	0.2	3.9	5.8	9.8
	2008	5	C	5.2	170.3	6.4	318.2	182.8	47.7	16.6	82.2	146.5	0.2	3.5	6.6	10.3
	2009	6	C	6.8	151.9	7.8	261.7	143.0	42.6	14.5	73.5	130.7	0.1	2.4	4.8	7.3
	2009	7	C	5.5	121.5	6.2	173.7	81.2	34.6	11.5	59.3	105.4	0.2	2.2	4.9	7.3
	2009	8	C	4.6	188.2	6.1	413.9	262.0	52.8	18.7	90.5	162.0	0.2	4.3	7.6	12.1
	2009	9	C	7.0	169.9	8.4	362.9	228.0	47.6	16.5	82.0	146.1	0.2	2.6	5.0	7.8
	2009	10	C	6.9	175.2	8.3	385.3	245.5	49.1	17.2	84.4	150.7	0.2	2.8	5.2	8.2
	2009	11	F	5.6	131.8	6.5	217.5	116.3	37.3	12.5	64.1	113.9	0.2	2.4	5.1	7.6
	2009	12	C	4.7	130.6	5.6	233.3	133.1	37.0	12.3	63.6	112.9	0.2	2.7	5.8	8.7
	2009	13	C	7.9	111.3	8.8	225.7	140.0	32.0	10.5	54.5	97.0	0.1	1.4	3.2	4.8
	2009	14	C	7.8	44.9	8.0	43.4	10.7	15.7	4.9	23.4	44.0	0.1	0.8	1.5	2.4

	2009	15	C	8.9	97.9	9.5	146.4	71.8	28.6	9.3	48.2	86.1	0.1	1.2	2.6	3.9
	2009	16	C	7.8	111.9	8.7	225.3	139.1	32.1	10.5	54.8	97.5	0.1	1.5	3.2	4.8
	2009	17	R	8.4	152.9	10.0	481.4	362.3	42.9	14.6	74.0	131.5	0.1	1.9	3.8	5.8
	2009	18	R	8.6	53.8	8.9	58.6	19.4	17.8	5.6	27.6	51.0	0.1	0.8	1.6	2.5
Nanyang	2009	1	R	6.3	139.8	7.2	243.0	134.8	39.4	13.3	67.9	120.5	0.1	2.3	4.8	7.2
	2009	2	R	6.2	55.2	6.5	52.3	12.8	18.2	5.7	28.3	52.2	0.1	1.2	2.2	3.5
	2009	3	R	5.4	203.8	7.3	524.1	357.3	57.3	20.8	97.9	176.0	0.2	4.1	6.9	11.2
Pingdingshan	2009	1	C	3.7	198.6	5.5	512.9	351.2	55.8	20.1	95.4	171.3	0.3	5.2	8.9	14.4
	2009	2	C	3.8	200.4	5.7	533.1	369.6	56.3	20.3	96.3	172.9	0.3	5.2	8.7	14.1
	2009	3	F	4.8	219.9	7.3	733.4	551.1	62.2	23.1	105.4	190.6	0.2	4.8	7.4	12.5
	2009	4	C	3.2	182.2	4.7	405.3	259.0	51.0	18.0	87.7	156.8	0.3	5.3	9.7	15.3
Shanmenxia	2009	1	C	4.5	206.0	6.4	554.8	386.0	58.0	21.1	98.9	177.9	0.2	4.8	7.9	13.0
	2009	2	R	5.6	147.6	6.6	256.5	141.6	41.5	14.1	71.5	127.1	0.2	2.7	5.6	8.4
	2009	3	R	4.3	206.9	6.2	559.2	389.5	58.2	21.2	99.3	178.7	0.3	5.0	8.2	13.5
	2009	4	C	6.1	123.5	6.8	167.4	74.8	35.1	11.6	60.3	107.0	0.1	2.1	4.6	6.8
Shangqiu	2009	1	F	6.8	201.0	8.4	434.7	270.6	56.5	20.4	96.5	173.4	0.2	3.5	5.9	9.6

	2009	2	F	5.9	221.2	8.7	843.9	660.3	62.6	23.2	106.0	191.8	0.2	4.1	6.3	10.6
	2009	3	F	6.7	240.0	8.9	640.3	437.8	68.5	26.2	114.8	209.5	0.2	4.8	6.6	11.6
	2009	4	F	6.3	232.4	8.7	702.3	507.5	66.1	25.0	111.2	202.2	0.2	4.5	6.5	11.3
Xinxiang	2008	1	F	6.8	87.8	7.3	111.8	47.1	26.1	8.4	43.6	78.0	0.1	1.4	3.1	4.6
	2008	2	F	6.4	272.0	9.0	738.6	503.1	79.1	32.1	129.8	241.0	0.3	6.4	7.4	14.0
	2009	3	C	5.6	211.6	7.1	371.4	197.1	59.7	21.9	101.5	183.1	0.2	4.6	7.3	12.2
	2009	4	F	7.1	226.6	9.1	548.6	359.5	64.3	24.1	108.5	196.9	0.2	4.1	6.1	10.4
	2009	5	C	7.7	189.8	9.2	423.5	270.1	53.2	18.9	91.3	163.4	0.2	2.9	5.1	8.1
Zhengzhou	2009	1	C	6.1	181.2	7.5	381.6	236.3	50.7	17.9	87.2	155.9	0.2	3.3	5.9	9.4
	2009	2	C	6.1	89.4	6.5	100.4	34.4	26.5	8.5	44.3	79.3	0.1	1.6	3.5	5.2
	2009	3	C	6.1	182.3	7.5	375.6	229.2	51.1	18.0	87.8	156.8	0.2	3.3	6.0	9.5
Zhoukou	2008	1	F	6.8	149.0	8.5	493.3	373.0	41.9	14.2	72.2	128.3	0.1	2.1	4.4	6.6
	2008	2	F	6.3	234.0	8.9	777.0	580.6	66.6	25.2	112.0	203.8	0.2	4.5	6.5	11.2
	2008	3	F	6.0	243.6	9.1	947.9	741.8	69.6	26.8	116.5	212.9	0.2	4.8	6.6	11.6
	2008	4	F	6.8	195.1	8.4	440.2	281.8	54.8	19.6	93.8	168.2	0.2	3.3	5.7	9.2
	2008	5	F	7.5	90.3	7.9	100.9	34.2	26.7	8.6	44.7	80.0	0.1	1.3	2.9	4.3

	2009	6	F	4.6	205.2	6.6	559.8	391.7	57.7	21.0	98.5	177.2	0.2	4.7	7.7	12.5
	2009	7	F	4.1	218.7	6.2	592.6	411.4	61.8	22.9	104.8	189.5	0.3	5.6	8.7	14.5
	2009	8	F	4.4	214.0	6.4	552.1	375.5	60.4	22.2	102.6	185.2	0.3	5.2	8.3	13.8
	2009	9	F	4.2	235.0	6.9	793.8	596.4	66.9	25.4	112.4	204.7	0.3	5.9	8.3	14.5
	2009	10	F	8.6	138.6	9.4	176.1	69.1	39.1	13.1	67.3	119.5	0.1	1.7	3.7	5.5
Zhumadian	2008	1	F	10.3	54.9	10.6	51.5	13.8	18.1	5.7	28.1	51.9	0.1	0.7	1.4	2.1
	2008	2	R	3.6	263.4	7.5	1225.6	999.1	76.2	30.4	125.8	232.3	0.3	7.1	8.6	16.0
	2008	3	R	5.8	229.3	8.9	943.8	752.0	65.1	24.5	109.8	199.4	0.2	4.3	6.3	10.8
	2008	4	R	5.1	249.0	8.8	1147.6	936.0	71.4	27.7	119.0	218.1	0.2	5.3	6.9	12.4
	2008	5	F	4.6	262.7	7.5	832.9	607.2	75.9	30.2	125.4	231.6	0.3	7.1	8.6	16.0
	2008	6	C	4.3	261.4	8.1	1153.3	929.0	75.5	30.0	124.8	230.3	0.3	6.4	7.9	14.6
	2009	7	F	7.5	160.9	8.9	393.5	266.7	45.1	15.5	77.8	138.4	0.1	2.3	4.5	6.9

Table 3. Economically and ecologically optimal N rate (kg N ha^{-1}), yield (Mg ha^{-1}), reactive N losses (Nr, kg N ha^{-1}) economic benefit (EB, \$ ha^{-1}) and net benefit (NB, \$ ha^{-1}) with different prices of maize, N fertilizer and equivalent cost of CO_2, PO_4 and SO_2. Data in bracket means the price levels used in this study, and the other two were the lowest and highest prices in 10 years for maize and N fertilizer, and were 75% and 125% of the used price for CO_2, PO_4 and SO_2. With site 2 in Hebei, for example.

	Price	Economically optimal					Ecologically optimal				
	\$ t^{-1}	N rate	Yield	Nr	EB	NB	N rate	Yield	Nr	EB	NB
Maize	245	228	8529	96	337	147	159	8199	60	306	182
	(360)	246	8574	107	575	367	196	8409	78	552	392
	409	250	8583	110	678	464	206	8452	83	656	487
N fertilizer	551	254	8589	113	615	398	204	8443	82	591	424
	(710)	246	8574	107	575	367	196	8409	78	552	392
	870	238	8556	102	537	337	188	8371	74	513	361
CO_2 equivalent	17.9	246	8574	107	575	383	200	8427	80	555	404
	(23.8)	246	8574	107	575	367	196	8409	78	552	392
	29.8	246	8574	107	575	351	192	8391	76	548	381
PO_4 equivalent	466	246	8574	107	575	376	199	8420	79	554	398
	(621)	246	8574	107	575	367	196	8409	78	552	392
	776	246	8574	107	575	364	196	8406	78	551	390
SO_2 equivalent	613	246	8574	107	575	396	202	8435	81	557	416
	(817)	246	8574	107	575	367	196	8409	78	552	392
	1021	246	8574	107	575	338	190	8381	75	546	370