Table S1 Changes in soil nitrogen (N) storage in soil (0−30 cm).

Plot	Depth	Bulk density† (Mg m^{-3})	Layer thickness (cm)	T-N (g kg^{-1})			Soil N storage (g N m^{-2})			Decrease in Soil N storage (g N m^{-2} y^{-1})	
				BS	AS	AR	BS	AS	AR	BS to AS (Soybean)	AS to AR (Rice)
C	0−10	1.12	10.0	1.67	1.69	1.74	186	189	194	9.2	8.9
	10−20	1.19	10.0	1.68	1.59	1.45	200	189	172		
	20−30	1.19	10.0	1.69	1.53	1.40	201	182	166		
	Total	-	-	-	-	-	587	560	533		
I	0−10	1.01	10.0	2.03	1.85	1.83	204	186	184	15.3	12.1
	10−20	1.11	10.0	1.80	1.69	1.56	200	188	173		
	20−30	1.11	12.4‡	1.76	1.64	1.50	242	226	207		
	Total	-	-	-	-	-	646	600	564		
M	0−10	1.08	10.0	2.14	1.95	2.02	231	210	217	10.8	10.4
	10−20	1.14	10.0	1.83	1.79	1.65	209	204	189		
	20−30	1.14	11.1‡	1.66	1.61	1.43	211	205	182		
	Total	-	-	-	-	-	651	619	588		

†Measured in May 2008. ‡Adjusted based on a soil mass basis to make the dry soil mass of the immature and mature compost plots equal to that of the control plot (0−30 cm). AR, after rice (April 2014); AS, after soybean (May 2011); BS, before study (November 2007); C, control; I, immature compost; M, mature compost; T-N, total nitrogen.

Table S2 Changes in nitrogen (N) accumulation in soybean and the percentage of N derived from dinitrogen (N_2) fixation during the growing period.

Year	Growth stage[†]	Date	DAS	N accumulation[‡] (g N m^{-2})			N derived from N_2 fixation[§] (%)		
				C	I	M	C	I	M
2008	V3	10-Jul	35	0.7	0.7	0.6	41.0	62.2	66.1
	R1	31-Jul	56	4.1	5.0	5.4	53.0	60.3	72.8
	R4	18-Aug	74	10.3	14.7	13.0	65.2	64.4	77.9
	R6	1-Sep	88	22.4	22.7	35.1	68.5	66.2	76.9
	R8	8-Oct	125	29.9	36.3	36.3	59.9	53.8	75.5
2009	V3	7-Jul	32	0.9	0.8	1.1	30.7	25.5	20.1
	R1	4-Aug	60	2.8	4.8	7.4	49.5	52.7	48.5
	R4	25-Aug	81	15.8	13.0	15.8	68.3	60.7	61.7
	R6	9-Sep	96	24.6	22.7	21.2	62.2	54.1	59.0
	R8	9-Oct	126	22.4	27.9	33.8	66.2	48.2	45.3
2010	V3	8-Jul	31	0.7	0.9	1.0	69.1	63.4	49.8
	R1	31-Jul	54	5.6	4.3	7.2	67.9	64.5	56.0
	R4	20-Aug	74	11.1	12.5	14.4	69.6	67.0	63.6
	R6	1-Sep	86	20.4	17.6	35.0	74.9	69.7	71.8
	R8	8-Oct	123	25.3	23.7	34.9	68.8	62.2	71.9

[†]V, vegetative stage; R, reproductive stage [21]. [‡]Including above and below ground biomass. [§]Determined by the relative ureide method. C, control; DAS, days after sowing; I, immature compost; M, mature compost

Table S3 Changes in numbers of tillers of rice during the growing period.

Year	Date	DAT	Number of tillers (m^{-2})		
			C	I	M
2011	27-May	0	89	89	89
	10-Jun	14	89	93	89
	17-Jun	21	133	171	164
	23-Jun	27	255	255	258
	8-Jul	42	389	404	360
	20-Jul	54	369	422	384
	12-Aug[†]	77	341	381	362
2012	27-May	0	89	89	89
	11-Jun	15	180	289	233
	18-Jun	22	329	480	366
	25-Jun	29	460	639	522
	6-Jul	40	724	819	770
	18-Jul	52	684	768	728
	25-Jul	59	595	746	693
	14-Aug[†]	79	426	493	491
2013	27-May	0	89	89	89
	13-Jun	17	109	120	120
	20-Jun	24	209	260	222
	27-Jun	31	322	411	366
	4-Jul	38	473	531	539
	17-Jul	51	451	422	444
	27-Jul	61	402	395	495
	13-Aug[†]	78	297	337	391
	17-Sep[†]	113	282	317	377

[†]Number of panicles. C, control; DAT, days after transplanting; I, immature compost; M, mature compost

Table S4 Yield and yield components of soybean for three years (2008−2010).

Year	Plot	Number of pods (pods m^{-2})	Number of grains (grains m^{-2})	100-grain weight[†] (g)	Grain yield[†] (g m^{-2})
2008	C	743	1239	34.0	410
	I	869	1529	34.9	511
	M	846	1491	34.6	498
2009	C	621	1050	34.0	322
	I	759	1343	33.6	410
	M	835	1449	34.1	437
2010	C	803	1419	26.8	291
	I	749	1349	26.3	324
	M	1083	1854	29.7	453
Average[‡]	C	722 a	1236 a	31.6 a	341a
	I	792 a	1407 ab	31.6 a	415 ab
	M	921 a	1598 b	32.8 a	463 b

[†]After sieving (5.5 mm) and its moisture contents were adjusted to 15%. [‡]Numbers within a column followed by different letters differ significantly among the plots (Two-way ANOVA [Year×Plot] followed by Tukey test, $P < 0.10$). C, control; I, immature compost; M, mature compost.

Table S5 Yield and yield components of rice for three years (2011−2013).

Year	Plot	Number of panicles (m^{-2})	Number of spikelets per panicle	Total number of spikelets ($\times 10^3$ m^{-2})	Filled spikelets[†] (%)	1000-kernel weight[‡] (g)	Grain yield[‡] (Brown rice) (g m^{-2})
2011	C	342	83.7	28.6	79.4	26.8	608
	I	380	97.5	37.0	63.4	25.7	652
	M	362	96.0	34.7	69.7	25.8	620
2012	C	426	59.7	25.4	91.3	23.0	526
	I	493	59.2	29.2	89.4	23.0	606
	M	491	61.5	30.2	86.9	22.9	556
2013[§]	C	282	77.2	21.8	83.4	21.1	422
	I	317	84.3	26.7	79.2	20.7	433
	M	377	78.3	29.5	68.3	21.1	403
Average[¶]	C	350 a	73.5 a	25.3 a	84.7 a	23.6 a	519 a
	I	397 ab	80.3 a	31.0 b	77.3 a	23.1 a	563 b
	M	410 b	78.6 a	31.5 b	74.9 a	23.3 a	527 ab

Rice cultivar was Yumeobako (2011) and Akitakomachi (2012 and 2013). [†]Estimated by submerging unhulled spikelets in a NaCl solution with a specific gravity (g cm^{-3}) of 1.06. [‡]After sieving (1.9 mm) and its moisture contents were adjusted to 15%. [§]In 2013, rice plants were damaged severely by insects. [¶]Numbers within a column followed by different letters differ significantly among the plots (Two-way ANOVA [Year×Plot] followed by Tukey test, $P < 0.10$). C, control; I, immature compost; M, mature compost.

Table S6 Annual nitrogen (N) flows and budgets during the soybean cultivation for three years (2008−2010).

Year[†]	Plot	N flow (g N m^{-2} y^{-1})									
		Input					Output				N budget
		Bulk N deposition	Seed	Symbiotic N_2 fixation	Fertilizer	Total	Harvested grain	Leaching	N_2O emission	Total	
2008	C	1.53	0.43	17.9	0.0	19.9	25.9	3.94	0.17	30.0	-10.2
	I	1.53	0.43	19.5	0.0	21.5	30.8	5.03	0.27	36.1	-14.6
	M	1.53	0.43	27.4	0.0	29.4	30.5	5.46	0.09	36.1	-6.7
2009	C	1.50	0.43	14.9	2.0	18.8	19.9	9.63	0.19	29.7	-10.9
	I	1.50	0.43	13.4	2.0	17.3	24.9	10.86	0.27	36.0	-18.7
	M	1.50	0.43	15.3	2.0	19.2	28.3	10.17	0.19	38.7	-19.4
2010	C	1.99	0.34	17.4	2.0	21.7	20.7	8.77	0.14	29.6	-7.9
	I	1.99	0.34	14.8	2.0	19.1	20.2	9.19	0.17	29.6	-10.4
	M	1.99	0.34	25.1	2.0	29.4	30.3	8.51	0.13	38.9	-9.5
Average[‡]	C	1.67	0.40	16.7 ab	1.3	20.1 ab	22.2 a	7.45 a	0.17 ab	29.8 a	-9.6 a
	I	1.67	0.40	15.9 a	1.3	19.3 a	25.3 ab	8.36 a	0.24 b	33.9 ab	-14.6 a
	M	1.67	0.40	22.6 b	1.3	26.0 b	29.7 b	8.05 a	0.14 a	37.9 b	-11.9 a

[†]Measurement period for 2008, 2009 and 2010 was early June 2008−early June 2009, early June 2009−early June 2010 and early June 2010−late May 2011, respectively. [‡]Numbers within a column followed by different letters differ significantly among the plots (Two-way ANOVA [Year×Plot] followed by Tukey test, $P < 0.10$). C, control; I, immature compost; M, mature compost; N_2, dinitrogen.

Table S7 Amounts of nitrogen (N) output via leaching during the soybean cultivation and fallow seasons (2008−2011).

Plot	N leaching (g N m^{-2})								
	2008−2009			2009−2010			2010−2011		
	Cultivation season†	Fallow season‡	Total	Cultivation season†	Fallow season‡	Total	Cultivation season†	Fallow season‡	Total
C	0.68	3.27	3.94	4.69	4.94	9.63	5.44	3.75	9.19
I	0.46	4.57	5.03	5.15	5.70	10.86	4.60	4.17	8.77
M	0.49	4.97	5.46	3.98	6.20	10.17	4.93	3.57	8.51

†Late May−early October. ‡Early October−late May. C, control; I, immature compost; M, mature compost.

Table S8 Annual nitrogen (N) flows and budgets during the rice cultivation for three years (2011−2013).

Year[†]	Plot	N flow (g N m^{-2} y^{-1})													
		Input						Output							
		Bulk N deposition	Irrigation	Seedling	N_2 fixation[‡]	Fertilizer	Total	Harvested grain	Surface drainage	Leaching	N_2O emission	NH_3 volatilization[§]	N_2 emission via denitrification[¶]	Total	N budget
2011	C	1.37	0.26	0.10	2.0	3.0	6.8	8.06	0.35	2.87	0.01	0.04	1.16	12.5	12.5
	I	1.37	0.28	0.10	2.0	3.0	6.8	8.56	0.38	3.32	0.04	0.04	1.16	13.5	13.5
	M	1.37	0.27	0.10	2.0	3.0	6.8	7.92	0.61	3.21	0.02	0.04	1.16	13.0	13.0
2012	C	1.87	0.39	0.16	2.0	8.0	12.4	6.32	0.45	4.56	0.03	0.11	2.44	13.9	13.9
	I	1.87	0.39	0.16	2.0	8.0	12.4	7.36	0.33	4.92	0.05	0.11	2.44	15.2	15.2
	M	1.87	0.38	0.16	2.0	8.0	12.4	7.63	0.42	5.36	0.02	0.11	2.44	16.0	16.0
2013	C	1.66	0.23	0.09	2.0	10.0	14.0	5.16	1.13	4.40	0.00	0.14	2.96	13.8	13.8
	I	1.66	0.23	0.09	2.0	10.0	14.0	5.17	1.25	5.47	0.12	0.14	2.96	15.1	15.1
	M	1.66	0.24	0.09	2.0	10.0	14.0	6.97	1.33	5.75	0.06	0.14	2.96	17.2	17.2
Average[♯]	C	1.60	0.29	0.12	2.0	7.0	11.1	6.51 a	0.64 a	3.94 a	0.01 a	0.10	2.19	13.4 a	-2.3 b
	I	1.60	0.30	0.12	2.0	7.0	11.1	7.03 a	0.65 a	4.57 ab	0.07 a	0.10	2.19	14.6 ab	-3.5 ab
	M	1.60	0.30	0.12	2.0	7.0	11.1	7.50 a	0.79 a	4.77 b	0.03 a	0.10	2.19	15.4 b	-4.3 a

[†]Measurement period for 2011, 2012 and 2013 was late May 2011−late May 2012, late May 2012−late May 2013 and late May 2013−late May 2014, respectively. [‡]Referred from Yasuda et al. [28]. [§]Estimated as the sum of N_2 derived from fertilizer (25.8 % of the fertilized N) and from the soil (0.38 g N m-2) [29]. [¶]Estimated as 1.4 % of fertilized N [30]. [♯]Numbers within a column followed by different letters differ significantly among the plots (Two-way ANOVA [Year*Plot] followed by Tukey test, $P < 0.10$). C, control; I, immature compost; M, mature compost; N_2, dinitrogen.

Table S9 Amounts of nitrogen (N) output via leaching during the rice cultivation and fallow seasons (2011−2014).

Plot	N leaching (g N m^{-2})								
	2011−2012			2012−2013			2013−2014		
	Cultivation season†	Fallow season‡	Total	Cultivation season†	Fallow season‡	Total	Cultivation season†	Fallow season‡	Total
C	0.41	2.46	2.87	0.31	4.24	4.56	0.35	4.05	4.40
I	0.55	2.77	3.32	0.73	4.19	4.92	0.62	4.86	5.47
M	0.44	2.77	3.21	0.65	4.71	5.36	0.47	5.28	5.75

†Late May−early October. ‡Early October−late May. C, control; I, immature compost; M, mature compost.

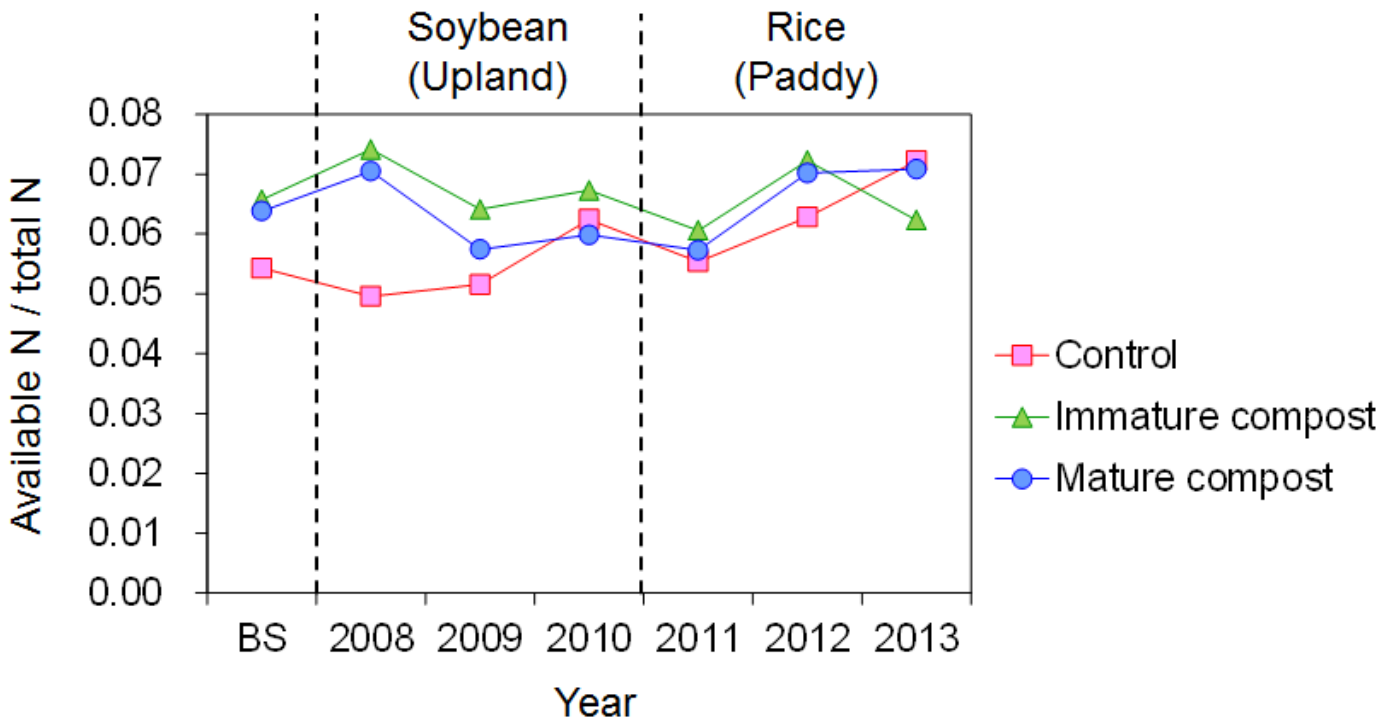

Figure S1 Inter-annual variation of available nitrogen (N): total N ratio of the surface soil (0–10 cm) after cultivation of each year. Total N in soil was determined using the N/C analyzer as described in 2.4. BS, before the beginning of the study.