Supplementary materials

Table S1 Soil bulk density (g cm^{-3}) and monthly soil temperature (°C) under different tillage practices during the growing season of soybean.

	Treatment	Soil temperature (°C)						Soil bulk density (g cm^{-3})					
		April	May[a]	June	July	August	September	April	May[a]	June	July[a]	August	September[a]
0–5 cm	CT	11.6	17.0	22.4	25.2	21.6	15.7	1.06	1.08	1.15	1.25	1.36	1.42
		(0.3)	(0.5)	(0.7)	(1.0)	(0.2)	(0.3)	(0.07)	（0.02）	(0.04)	(0.02)	(0.05)	(0.03)
	RT	10.7	16.1	21.5	23.6	21.3	16.0	1.00	1.05	1.10	1.16	1.22	1.27
		(0.3)	(0.6)	(0.9)	(0.3)	(0.2)	(0.2)	(0.04)	(0.02)	(0.04)	(0.05)	(0.06)	(0.02)
	NT	9.0	15.0	21.0	23.3	21.1	15.8	0.96	1.09	1.11	1.19	1.23	1.28
		(0.7)	(0.7)	(0.8)	(0.4)	(0.2)	(0.4)	(0.05)	(0.03)	(0.03)	(0.05)	(0.06)	(0.01)
5–15 cm	CT	9.5	15.6	21.7	24.5	21.6	16.1	1.11	1.13	1.14	1.22	1.30	1.30
		(0.3)	(0.4)	(0.5)	(0.9)	(0.3)	(0.5)	(0.08)	(0.07)	(0.07)	(0.05)	(0.04)	(0.01)
	RT	8.7	14.7	20.7	22.8	21.0	16.9	1.23	1.25	1.26	1.33	1.38	1.40
		(0.3)	(0.3)	(0.7)	(0.9)	(1.3)	(1.2)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)	(0.02)
	NT	6.6	13.6	20.5	22.6	21.0	15.7	1.27	1.32	1.30	1.37	1.42	1.42
		(0.8)	(0.6)	(0.8)	(0.4)	(0.2)	(0.3)	(0.03)	(0.05)	(0.03)	(0.04)	(0.03)	(0.02)

CT, conventional tillage; RT, ridge tillage; NT, no tillage; 'a' indicates the value was calculated by linear interpolation from the sampled months.

20   **Table S2** Physiological parameter values[1] for the soil biota.

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	Functional group	P_e (C/C)	A_e (C/C)	a	b	T (°C)	Body C:N ratio
Microbes	Bacteria	0.30	1.00	-	-	-	5
	Fungi	0.30	1.00	-	-	-	10
Nematodes	Bacterivores	0.37	0.60	29.25	0.72	20	10
	Fungivores	0.37	0.38	29.25	0.72	20	10
	Plant-parasites	0.37	0.25	29.25	0.72	20	10
	Omnivores-predators	0.37	0.50	29.25	0.72	20	10
Mites	Fungivores	0.35	0.50	7.2	0.69	10	8
	Predators	0.35	0.60	102	0.87	10	8
Collembolans	Fungivores	0.35	0.50	63	0.73	18	8
	Predators	0.35	0.50	63	0.73	18	8

22   [1], source from Didden et al. (1994) and de Ruiter et al. (1993).

23   P_e, production efficiency.

24   A_e, assimilation efficiency.

25   a and b, constants for the respiration equation $Q = aW^b$ (see text); the constants presuppose Q (oxygen consumption rate) as O_2 µL ind.$^{-1}$ h^{-1}.

26   T, temperature at which a and b were determined.

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Table S3 Food preferences (percentage)[*] for the different taxonomic groups of soil biota.

Food source	Bacteria	Fungi	Nematodes				Mites		Collembolans	
			Bacterivores	Fungivores	Plant-parasites	Omnivores-predators	Fungivores	Predators	Fungivores	Predators
Root (C:N = 7.5)[a]	-	-	-	20	100	10	-	-	-	-
Detritus (C:N = 13/11)[b]	100	100	-	-	-	-	-	-	-	-
Bacteria (C:N = 5)	-	-	95	-	-	65	-	-	-	-
Fungi (C:N =10)	-	-	-	80	-	-	100	-	100	-
Protists (C:N = 5)	-	-	5	-	-	5	-	-	-	-
Nematodes (C:N = 10)	-	-	-	-	-	20	-	25	-	100
Collembolans (C:N = 8)	-	-	-	-	-	-	-	75	-	-
Food C:N ratio[c]	14	14	5	9.5	7.5	6.25	10	8.5	10	10

[*], source from Didden et al. (1994) and de Ruiter et al. (1993).

[a], the C:N ratio of the cytoplasm of plant cells (Verschoor et al., 2002).

[b], measured in our lab, the C:N ratio of detritus of conservation and conventional tillage was 13 and 11, respectively.

[c], calculated following Rashid et al. (2014); Food C:N ratio = ($\sum$foodpreference $\times$ C:N$_{foodsource}$)/100.

Table S4 Mean value of soil biotic biomass (expressed as mg C m^{-2}) under different tillage practices during the growing season of soybean (means (SE), n = 4).

Functional group		0–5 cm			5–15 cm			ANOVA		
		CT	RT	NT	CT	RT	NT	Tillage (T)	Depth (D)	T × D
Microbes	Bacteria	1012.9 (83.2)	1227.9 (66.5)	1408.6 (234.7)	1499.9 (227.0)	1898.8 (220.7)	2129.9 (122.2)	< 0.001	< 0.001	ns
	Fungi	2731.1 (218.2)	3729.2 (273.2)	4441.1 (476.8)	3093.0 (401.5)	3989.7 (403.6)	4361.3 (294.8)	< 0.001	ns	ns
Nematodes[a]	Bacterivores	7.44 (1.54) b	22.66 (3.84) a	15.97 (4.38) a	6.32 (1.57) c	9.76 (0.97) b	14.19 (2.49) a	< 0.001	< 0.001	0.003
	Fungivores	0.83 (0.05) a	0.49 (0.13) b	0.62 (0.19) ab	1.07 (0.20) b	1.06 (0.14) b	1.85 (0.19) a	0.001	< 0.001	< 0.001
	Plant-parasites	4.12 (1.8)	2.85 (0.95)	6.02 (2.22)	9.08 (3.10)	7.37 (3.07)	12.04 (4.36)	0.027	< 0.001	ns
	Omnivores-predators	2.54 (0.36)	2.56 (0.67)	3.19 (0.65)	14.00 (5.18)	11.58 (4.42)	33.36 (10.62)	0.018	< 0.001	ns
Mites[b]	Fungivores	1.01 (0.26) b	2.00 (0.76) ab	2.20 (0.69) a	0.76 (0.56) a	0.76 (0.09) a	0.69 (0.28) a	ns	< 0.001	0.049
	Predators	0.03 (0.01) b	0.07 (0.03) ab	0.08 (0.02) a	0.01 (0.01) a	0.02 (0.01) a	0.01 (0.02) a	0.015	< 0.001	0.012
Collembola[b]	Fungivores	0.69 (0.47)	1.16 (0.62)	1.27 (0.42)	0.75 (0.48)	0.48 (0.19)	0.34 (0.08)	ns	0.005	ns

Predators	21.70 (4.67) b	43.57 (4.90) a	36.78 (5.32) a	23.86 (12.34) ab	26.46 (6.57) a	10.93 (6.45) c	0.013	0.001	0.006
Total soil organisms	3782.4 (300.3)	5032.4 (298.4)	5915.9 (1499.7)	4648.8 (611.0)	5945.9 (816.5)	6564.6 (387.0)	< 0.001	0.009	ns

43 CT, conventional tillage; RT, ridge tillage; NT, no tillage. Two-way ANOVA was used to test the effect of tillage and soil depth on the variables. When significant
44 interaction occurred, the pairwise differences between CT and RT and NT were tested with Tukey's honestly significant difference at each soil depth. Means for the
45 different tillage systems at the same depth and followed by the same lowercase letter are not significantly different ($P > 0.05$).
46 [a], nematode biomass was calculated as W × 20% × 52%, where W is the body fresh biomass, 20% is the conversion factor from fresh biomass to dry biomass and
47 52% is the C content in dry biomass (Ferris, 2010).
48 [b], mite and Collembolan biomass were estimated by the dry biomass (D) based on the regression equations according to Hódar (1996) and Douce (1976), respectively.
49 Then the C content in biomass was calculated using an average C content of 48% dry biomass (Berg et al., 1998).

Table S5 The amount of mineral N (expressed as kg N ha^{-1}) delivered by different groups of soil biota in different tillage practices during the

growing season of soybean (means (SE), n = 4).

Functional groups		0–5 cm			5–15 cm			ANOVA		
		CT	RT	NT	CT	RT	NT	Tillage (T)	Depth (D)	T × D
Total soil organisms		87.21 (11.18)	108.83 (9.40)	127.46 (36.03)	92.10 (16.05)	109.94 (14.39)	123.62 (5.57)	0.002	ns	ns
Microbe	Bacteria	11.03 (1.44)	12.47 (0.51)	14.17 (2.52)	14.97 (2.66)	17.41 (2.07)	19.58 (0.74)	0.003	< 0.001	ns
	Fungi	74.69 (9.81)	93.64 (9.17)	110.95 (26.25)	75.07 (13.71)	90.50 (12.36)	101.44 (4.84)	0.002	ns	ns
Nematode	Bacterivores	0.42 (0.10) b	1.15 (0.18) a	0.89 (0.22) a	0.39 (0.08) b	0.53 (0.06) ab	0.73 (0.15) a	< 0.001	< 0.001	0.002
	Fungivores	0.06 (0.01) a	0.03 (0.01) b	0.04 (0.02) ab	0.07 (0.01) b	0.06 (0.01) b	0.11 (0.02) a	< 0.001	< 0.001	< 0.001
	Plant-parasites	0.27 (0.08)	0.25 (0.09)	0.44 (0.10)	0.57 (0.13)	0.48 (0.13)	0.65 (0.17)	0.016	< 0.001	ns
	Omnivores-predators	0.16 (0.03) a	0.13 (0.07) a	0.16 (0.02) a	0.46 (0.14) b	0.42 (0.11) b	0.88 (0.29) a	0.004	< 0.001	0.011
Mite	Fungivores	0.022 (0.006)	0.039 (0.017)	0.034 (0.009)	0.010 (0.006)	0.011 (0.001)	0.007 (0.003)	ns	< 0.001	ns
	Predators	0.0009 (0.0003)	0.0022 (0.0013)	0.0020 (0.0001)	0.0003 (0.0002	0.0003 (0.0002)	0.0002 (0.0001)	ns	< 0.001	ns

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Collembolan	Fungivores	0.03 (0.02) a	0.06 (0.03) a	0.06 (0.02) a	0.05 (0.03) a	0.03 (0.01) a	0.02 (0.01) a	ns	0.037	0.031
	Predators	0.52 (0.12) b	1.06 (0.21) a	0.72 (0.08) b	0.50 (0.15) a	0.51 (0.07) a	0.21 (0.18) b	0.001	< 0.001	0.003

53 CT, conventional tillage; RT, ridge tillage; NT, no tillage. Two-way ANOVA was used to test the effect of tillage and soil depth on the variables. When significant
54 interaction occurred, the differences between CT and RT and NT were tested with Tukey's honestly significant difference at each soil depth. Means for the different
55 tillage systems at the same depth and followed by the same lowercase letter are not significantly different ($P > 0.05$).
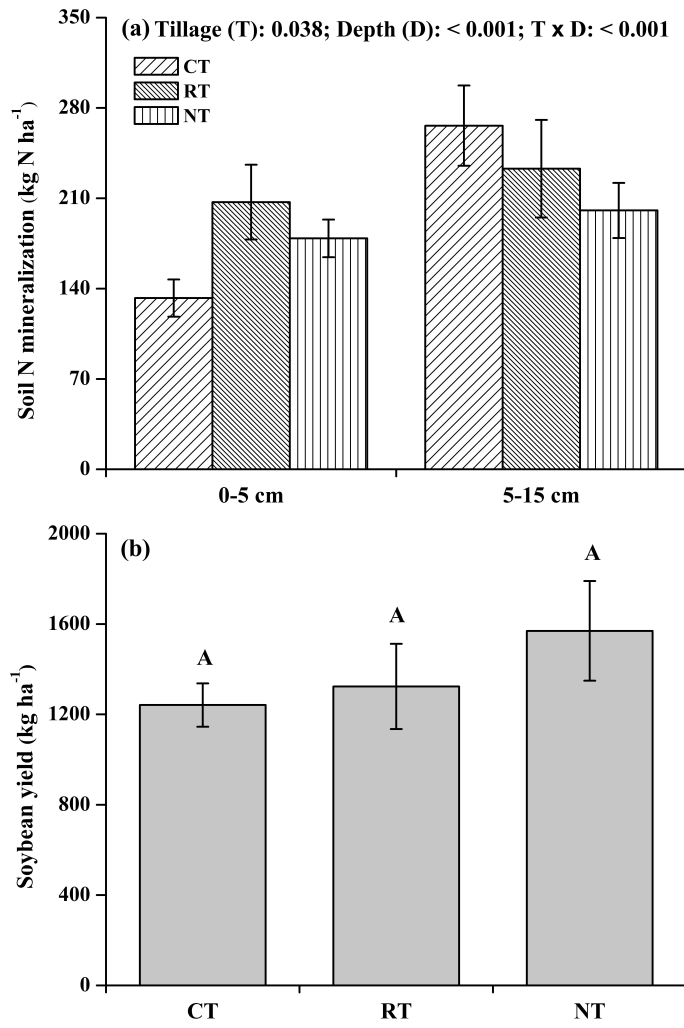
Fig. S1 Soil N mineralization (SNM) during soybean growing season (a) and soybean yield (b) under different tillage practices (mean ± standard error). Tillage practices capped by the same uppercase letter are not significantly different ($P > 0.05$). CT, conventional tillage; RT, ridge tillage; NT, no tillage.
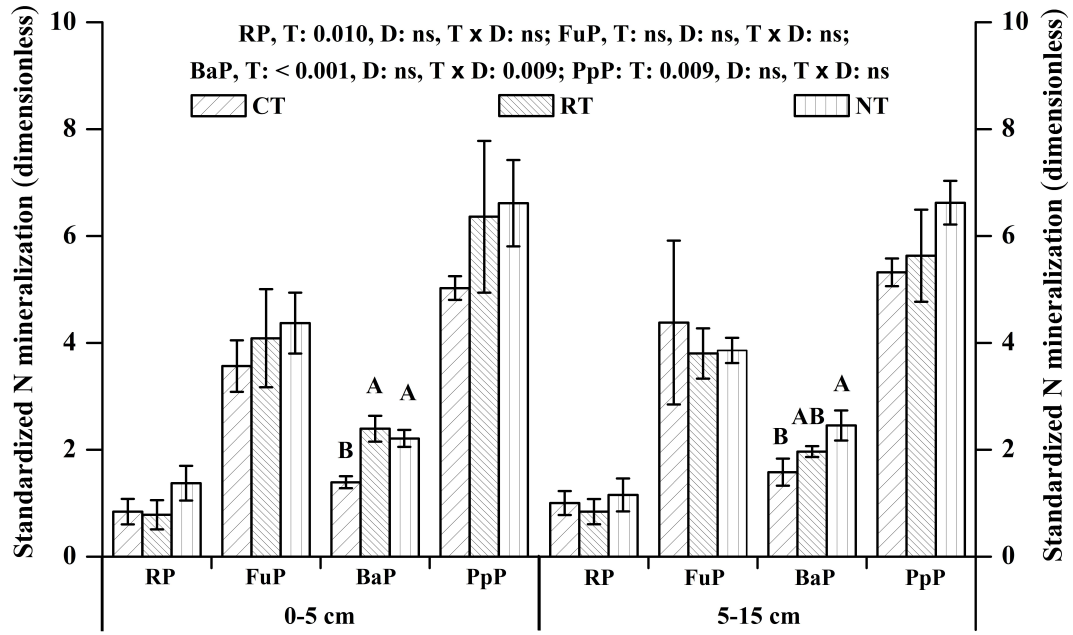
**Fig. S2** Contribution of energy pathways to N mineralization based on standardization under different tillage practices (mean ± standard error) at 0–5 (a) and 5–15 (b) cm depths during soybean growing season. For the same energy pathway at each soil depth, tillage practices capped by the same uppercase letter are not significantly different ($P > 0.05$). RP, root pathway; FuP, fungal pathway; BaP, bacterial pathway; PpP, predator-prey pathway.
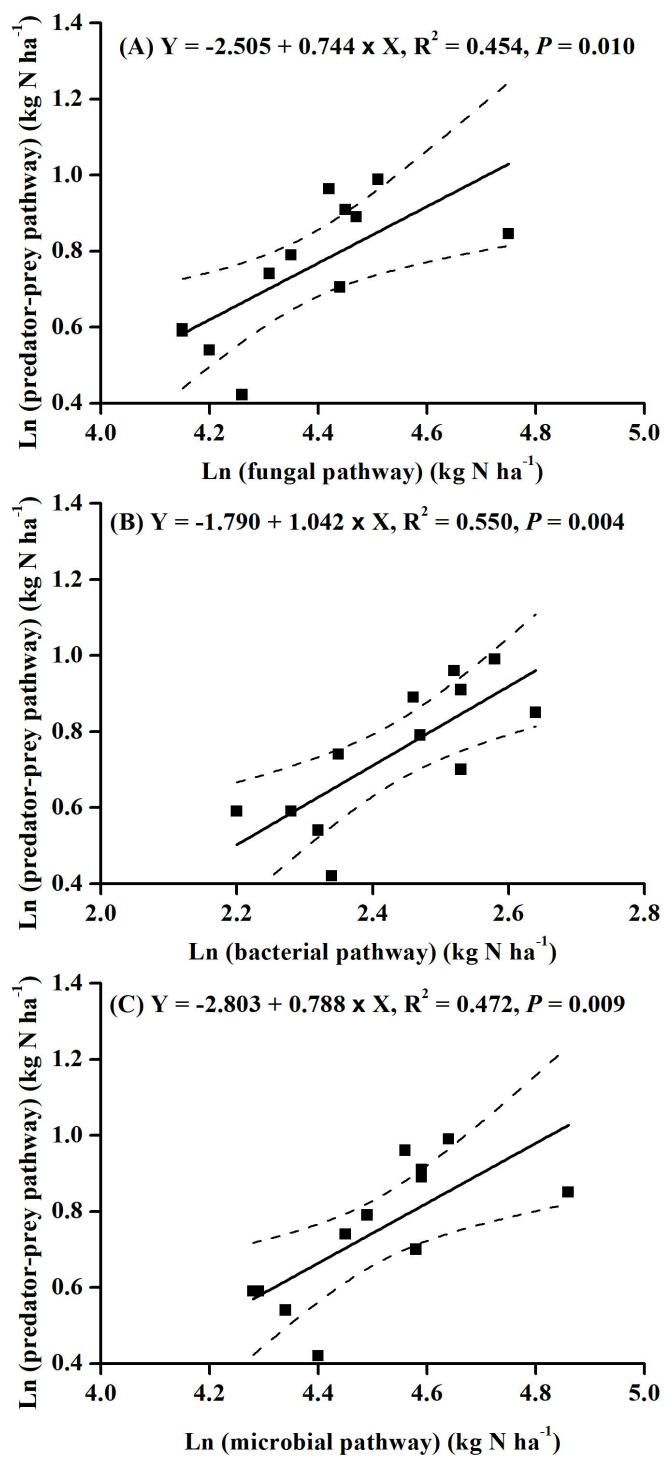
Fig. S3 Linear relationship between bacterial, fungal and microbial (bacterial + fungal) pathway and predator-prey pathway in N mineralization (kg ha^{-1}) in the plough layer (0–15 cm) during the soybean growing season. The dashed lines show the 95% confidence intervals of mean prediction for the regression line.