Table S1 Parameters for organic fertilizers (chicken manure, vermicompost, and rapeseed cake) used in the present study.

Parameter	Chicken	Vermicompost	Rapeseed
pH	7.25	7.72	7.63
carbon to nitrogen ratio (C/N)	10.37	7.25	9.14
total carbon (%)	16.60	14.50	38.10
total nitrogen (%)	1.60	2.00	4.20
available nitrogen (%)	0.23	0.25	0.47
total phosphorus (%)	1.20	1.70	2.30
available phosphorus (%)	0.37	0.52	0.85
total potassium (%)	0.70	1.00	1.60
available potassium (%)	0.59	0.83	1.33

Table S2 Soil chemical properties and enzymes. TN, total nitrogen; TC, total carbon; C/N, carbon to nitrogen ratio; AN, Alkali-hydrolyzable N; N_NH_4^+, ammoniacal N; N_NO_3^-, nitrate nitrogen; TP, total P; AK; available K; CEC, cation exchange capacity; S_SC, sucrase, S_EC, cellulase; S_CAT, catalase; S_NR, nitrate reductase; S_AKP, alkaline phosphatase; the same below.

Treatments	TN	TC	C/N	AN	N_NH_4^+	N_NO_3^-	TOC	TP	AP	AK	CEC	S_SC	S_EC	S_CAT	S_NR	S_AKP
RW																
CK1	0.40±0.03 e	6.50±0.25 cde	17.62±3.08a	55.47±3.70def	16.04±0.88g	10.80±0.65d	4.82±0.12de	0.28±0.02ef	8.83±0.47f	181.61±2.89g	17.81±0.44f	45.21±0.47f	609.95±6.30g	58.54±0.50a	29.72±3.37bc	5.76±0.07de
CK2	0.56±0.05 bcde	6.88±0.02 bcde	12.57±1.11b	56.48±0.09def	17.36±0.07fg	11.29±0.25cd	5.22±0.11cd	0.29±0.01de	10.36±0.51 ef	196.55±0.38e	19.85±0.51de	43.71±0.31f	630.74±12.27fg	57.33±0.20c	31.87±0.57bc	4.10±0.02f
Chicken	0.70±0.01 ab	8.00±0.03 ab	11.49±0.07b	76.44±2.73b	16.09±0.43g	12.67±0.33c	7.18±0.24a	0.32±0.01bcd	17.34±1.53 bc	214.40±0.92d	21.63±0.05c	70.58±0.48c	803.99±17.32cd	58.55±0.14ab	29.14±0.35bc	4.05±0.08f

Vermicompost	0.68±0.02abc	7.40±0.03ab	11.06±0.23b	68.29±0.60c	18.74±0.51def	11.49±0.11cd	5.43±0.10c	0.33±0.00abc	15.48±0.64bcd	184.57±1.02fg	21.71±0.20bc	83.17±1.95b	1151.21±6.79a	28.79±0.02a	50.21±0.89a	7.77±0.07a
Rapeseed	0.59±0.01bcd	7.30±0.03ab	12.42±0.24b	88.11±1.50a	21.06±0.12abc	21.71±0.20b	6.46±0.16b	0.36±0.01ab	29.14±0.36a	246.64±2.58b	23.38±0.31a	103.79±1.06a	1026.44±0.43b	59.12±0.11a	31.84±0.33bc	5.71±0.02e
RG																
CK1	0.54±0.18bcde	6.80±1.50bcde	13.07±1.45b	49.41±3.36f	17.35±0.08fg	8.72±0.26f	3.62±0.01g	0.23±0.02g	13.42±0.94cdef	183.32±1.07g	19.83±0.74de	55.75±0.29de	515.16±23.68h	55.11±0.06e	34.69±2.70b	3.83±0.05fg
CK2	0.66±0.01abc	8.35±0.10a	12.70±0.09b	52.91±2.36ef	19.33±1.06def	9.12±0.34ef	4.11±0.17fg	0.25±0.02fg	14.13±1.27cde	192.79±2.06ef	20.36±0.19cd	55.46±0.77de	619.92±31.49fg	56.41±0.07d	45.64±2.18a	5.66±0.08e
Chicken	0.51±0.05cde	6.05±0.00def	11.95±1.22b	57.25±1.35def	19.86±0.10cde	8.84±0.62ef	4.28±0.02ef	0.29±0.03de	13.38±1.49cdef	198.40±1.96e	20.54±0.09cd	57.14±1.18de	630.22±28.27fg	59.08±0.49a	27.46±1.92c	6.35±0.16c
Vermicompost	0.53±0.04bcde	5.80±0.00ef	11.09±0.91b	62.39±1.79cd	20.67±0.31bcd	12.53±0.51c	3.59±0.03g	0.35±0.04ab	19.27±2.07b	216.09±4.19d	20.48±0.53cd	58.44±0.07de	754.86±46.38de	59.31±0.06a	48.89±2.80a	7.43±0.28ab
Rapeseed	0.61±0.02bcd	6.90±0.05bcde	11.37±0.34b	60.23±1.59de	22.02±0.66abc	24.70±0.25a	5.20±0.04cd	0.37±0.02a	15.93±0.23bcd	229.12±2.61c	20.68±0.08cd	59.82±0.89d	597.22±2.62g	59.19±0.03a	34.84±3.38b	5.97±0.18cde
RF																
CK1	0.46±0.01de	5.08±0.18f	11.16±0.33b	56.52±2.06def	18.16±0.00efg	9.15±0.07ef	4.82±0.14de	0.29±0.01de	11.60±1.84def	184.25±2.12fg	16.53±0.01g	27.94±0.78g	360.21±10.30i	57.43±0.26c	31.99±1.27bc	3.35±0.06g
CK2	0.80±0.00a	8.60±0.05a	10.77±0.06b	62.39±1.07cd	20.43±0.38bcd	10.22±0.54de	4.88±0.03cd	0.31±0.01cde	14.18±0.84cde	213.44±0.76d	17.94±0.31f	31.01±1.52g	372.21±19.68i	57.56±0.11c	34.39±1.08b	3.70±0.13fg
Chicken	0.69±0.01abc	7.63±0.58ab	11.25±0.88b	76.99±0.75b	22.04±0.06abc	12.62±0.05c	6.52±0.05b	0.36±0.02ab	14.54±0.80bcde	228.08±2.04c	18.76±0.32ef	53.26±1.39e	801.83±38.11cd	57.89±0.23bc	43.66±2.19a	6.91±0.28b
Vermicompost	0.61±0.05bcd	7.65±0.00ab	12.74±0.94b	76.15±0.88b	22.26±1.18ab	10.60±0.63d	4.96±0.01cd	0.34±0.05ab	17.88±1.36bc	263.20±2.92a	20.52±0.56cd	55.01±1.03de	700.02±32.73ef	57.96±0.04bc	44.80±0.85a	5.91±0.24cde

Rapeseed	0.61±0.01 bcd	7.75±0.05 ab	12.71±0. 13b	77.83±0.7 8b	23.26±0.7 2a	12.48±0. 28c	6.65±0. 03b	0.36±0.0 1ab	14.67±1.70 bcde	255.97±4. 05a	22.96±0. 45ab	66.66±3. 14c	869.07±6.6 9c	59.19±0. 14a	30.55±1. 48bc	6.30±0.3 4cd

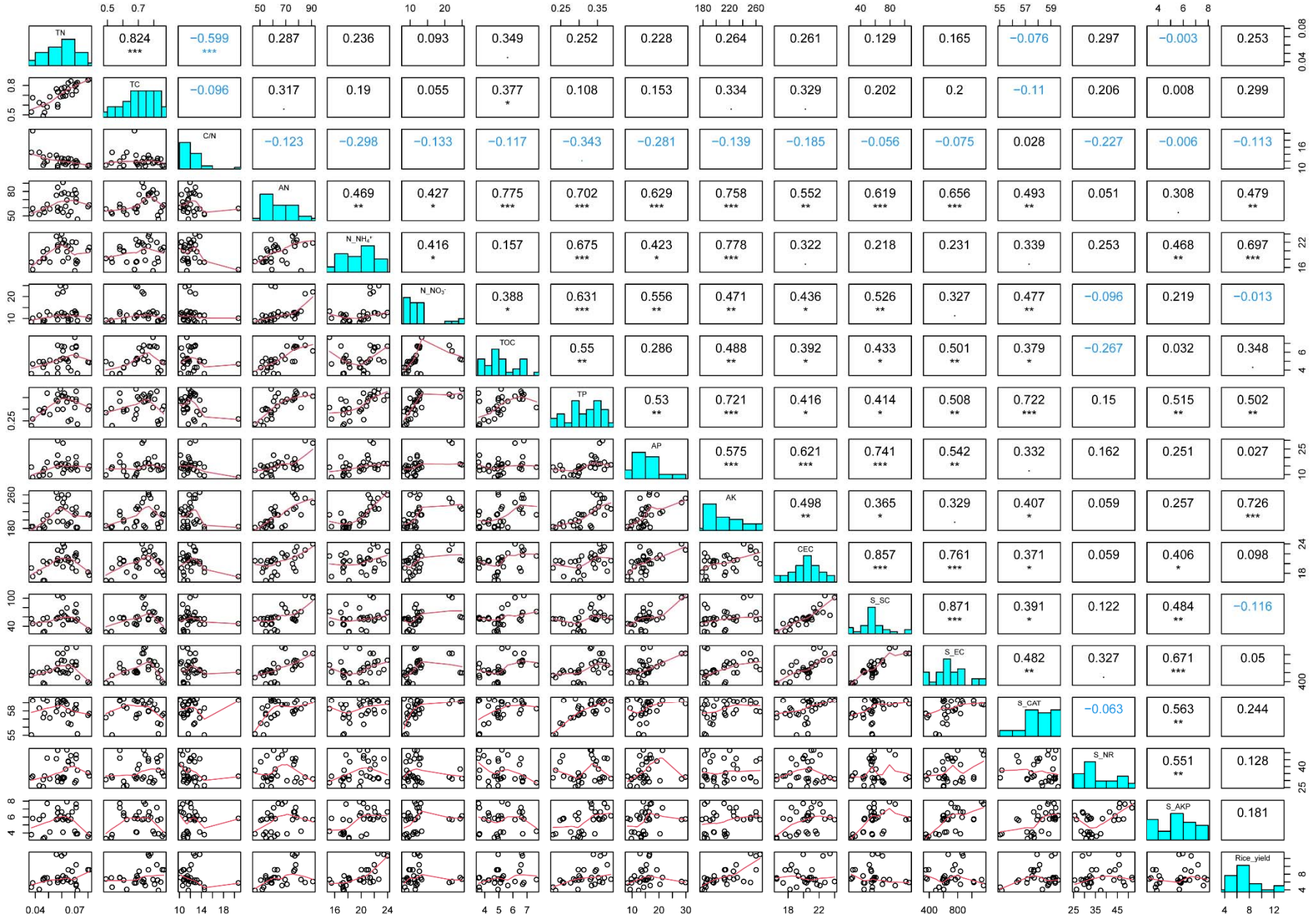
TN
TC
C/N
AN
N_NH4+
N_NO3-
TOC
TP
AP
AK
CEC
S_SC
S_EC
S_CAT
S_NR
S_AKP
Rice_yield

Figure S1. Relationships between rice grain yield and soil fertility. ***, P<0.001, **, P<0.01, *, P<0.05.

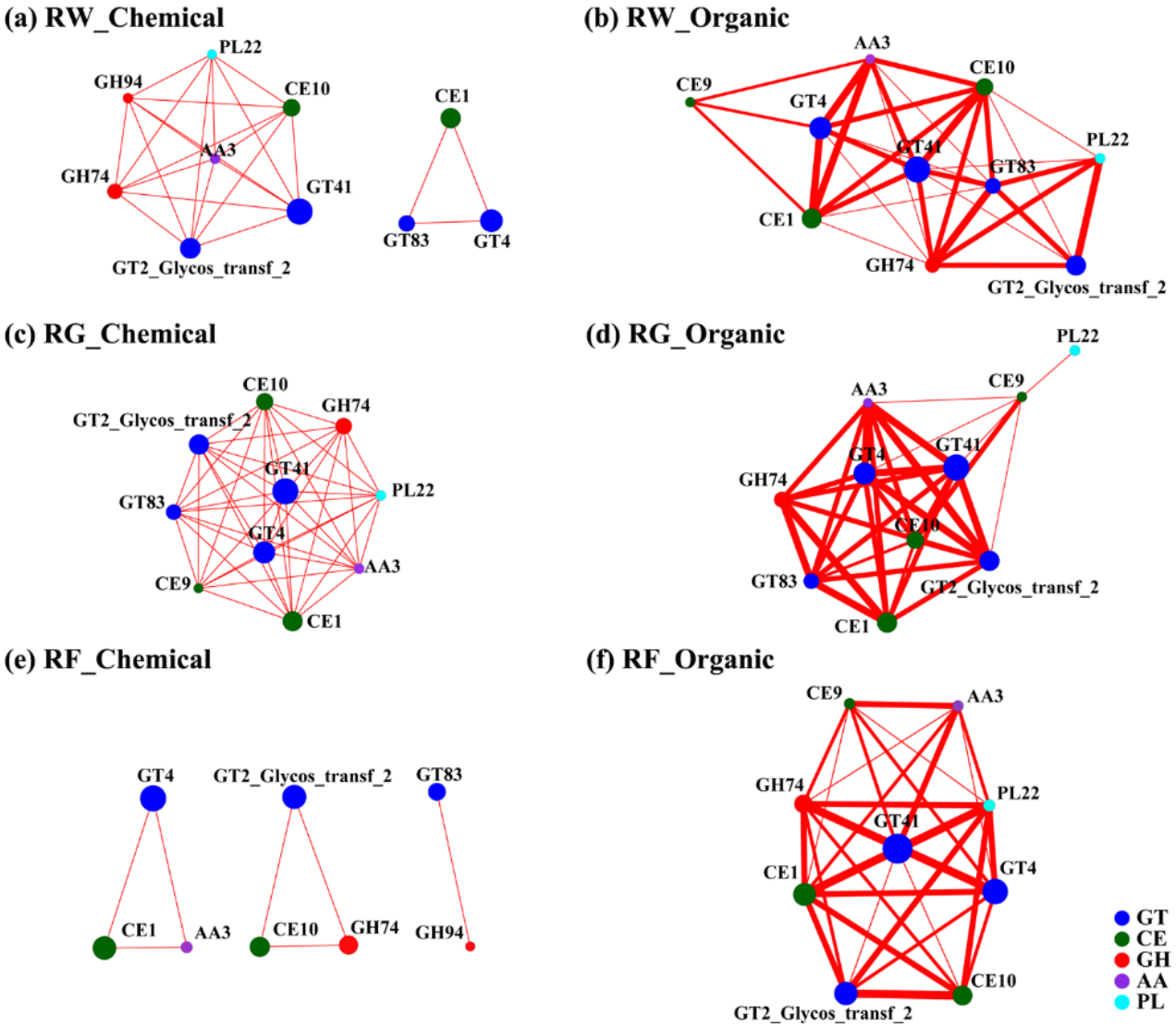
(a) RW_Chemical
PL22
GH94
CE10
AA3
GH74
GT41
GT2_Glycos_transf_2
CE1
GT83
GT4
(b) RW_Organic
AA3
CE10
CE9
GT4
GT41
PL22
GT83
CE1
GH74
GT2_Glycos_transf_2
(c) RG_Chemical
CE10
GH74
GT2_Glycos_transf_2
GT41
PL22
GT83
GT4
AA3
CE9
CE1
(d) RG_Organic
PL22
AA3
CE9
GT4
GT41
GH74
CE10
GT83
GT2_Glycos_transf_2
CE1
(e) RF_Chemical
GT4
GT2_Glycos_transf_2
GT83
CE1
AA3
CE10
GH74
GH94
(f) RF_Organic
CE9
AA3
GH74
PL22
GT41
CE1
GT4
CE10
GT2_Glycos_transf_2
GT
CE
GH
AA
PL

Figure S2 Network analysis within slow-release fertilizer treatments (Chemical) and organic fertilizer treatments (Organic) respectively, red line indicates positive relationship. The size of the nodes in the figure represents the abundance of function, with larger nodes corresponding to larger abundance values; all nodes are displayed in the same color. The color of the lines represents positive or negative correlations: red indicates a positive correlation between functions, and green indicates a negative correlation between functions; the thickness of the lines represents the size of the correlation coefficient values, with thicker lines indicating higher correlations between functions; the more lines there are, the more closely related the function is to other functions.