g-C_3N_4 promotes agro-ecosystem productivity: a case study for rice

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Table S1 The fertilizer application amount of different treatments.

Treatment Number	Material Description	Base fertilization (Second day after transplantation)			tillering fertilization (Day 12 after transplantation)	panicle fertilization (Day 42 after transplantation)
		Urea ($g \cdot m^{-2}$)	Potassium chloride ($g \cdot m^{-2}$)	Dicalcium phosphate ($g \cdot m^{-2}$)	Urea ($g \cdot m^{-2}$)	Urea ($g \cdot m^{-2}$)
CKU	-	7.2	30.62	20.05	7.2	9.6
CN-5	0.05% g-C_3N_4	7.2	30.62	20.05	7.2	9.6
CN-20	0.2% g-C_3N_4	7.2	30.62	20.05	7.2	9.6
FCN-5	0.05% Fe-C_3N_4	7.2	30.62	20.05	7.2	9.6
FCN-20	0.2% Fe-C_3N_4	7.2	30.62	20.05	7.2	9.6

TXT S1

Rice in the soil column experiment was grown in the semi-open shed (part of outdoor cultivation) without additional temperature and light control (Fig. S1); Rice planting is from June 23 to October 30, 2021, details of temperature and light are available on the China Meteorological Network (http://www.weather.com.cn/).

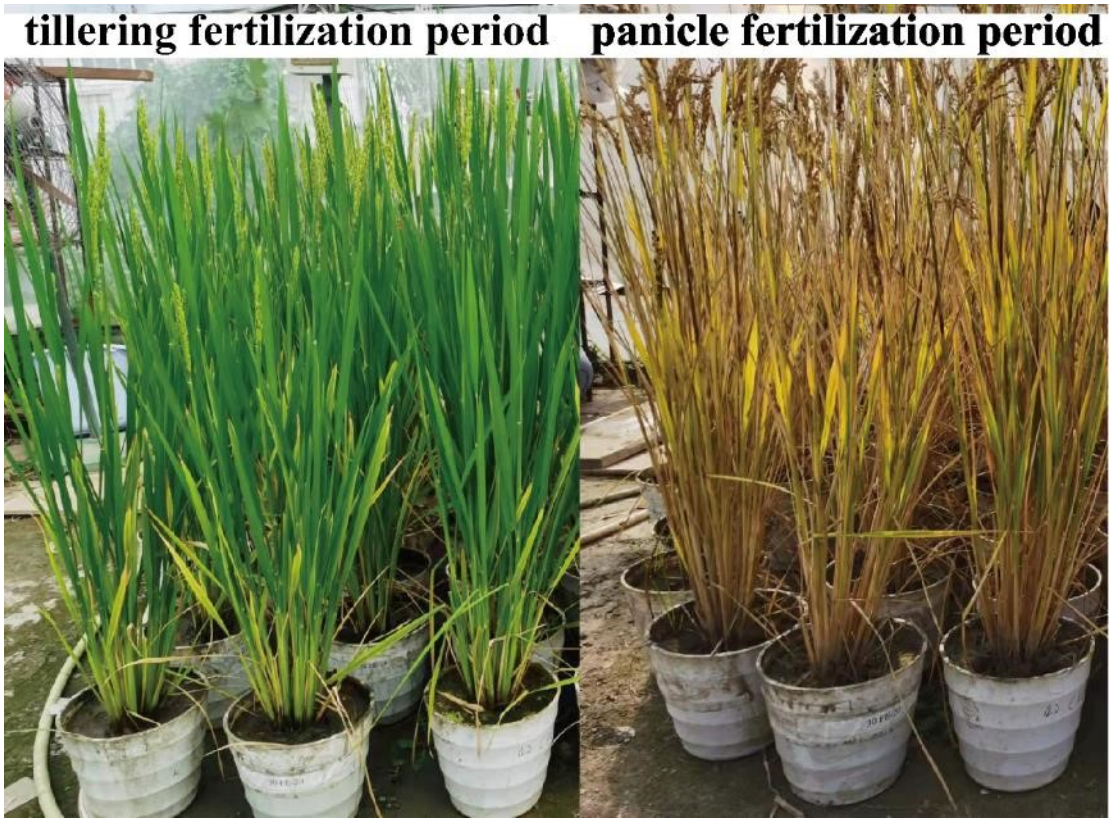

Figure S1. Rice growth pictures, left at tillering fertilization period, right at panicle fertilization period.

TXT S2

Plant growth and yield indicators: three parallel measurements per treatment, repeated three times; where the SPAD measurement was averaged over three different sections on the third or fourth fully expanded leaf located at the top of the plant; rice plant enzyme activity was extracted by grinding in an ice bath using a 0.01M phosphate buffer solution at a plant weight to buffer mass of 1:10 and 4°C The extracts were obtained by centrifugation and three parallel samples of each treatment were determined. TN and TP were converted from organic nitrogen and organic phosphorus to inorganic ammonium salts and inorganic phosphorus in plants passing through a 0.25 mm screen by high temperature digestion with sulphuric acid-hydrogen peroxide and then determined by acid-base titration (nitrogen titrator) and molybdenum blue ascorbic acid (UV spectrophotometer), respectively, with three parallel samples per treatment.

TXT S3

For the determination of surface water, three parallels for each treatment were carried out. COD was determined using the hash boiling method, using potassium dichromate as the oxidising agent and sulphuric acid at 150°C on fresh water samples, and determined using a spectrophotometer. NH_4^+-N and NO_3^--N water samples were filtered through qualitative filter paper and determined using a flow analyzer.

Soil was also determined in three parallel for each treatment. pH was determined using a pH meter on soil passing through a 2 mm screen with CO_2-free water at 1:2.5 (w/v); SOM was determined using soil passing through a 0.149 mm screen with sulphuric acid and potassium dichromate in an oil bath at 180°C, boiled for five minutes and titrated using the indicator o-phenanthroline and ferrous sulphate. Total soil nitrogen was determined using 0.25 mm air-dried soil with sulphuric acid and an extinction catalyst at high temperature until off-white using a nitrogen tester, while TP was determined using 0.149 mm air-dried soil with concentrated sulphuric acid and perchloric acid until white, then using the molybdenum blue ascorbic acid method (UV spectrophotometer). Fresh soil samples or fresh air-dried soil samples are used to ensure that soil enzyme activity is not affected.

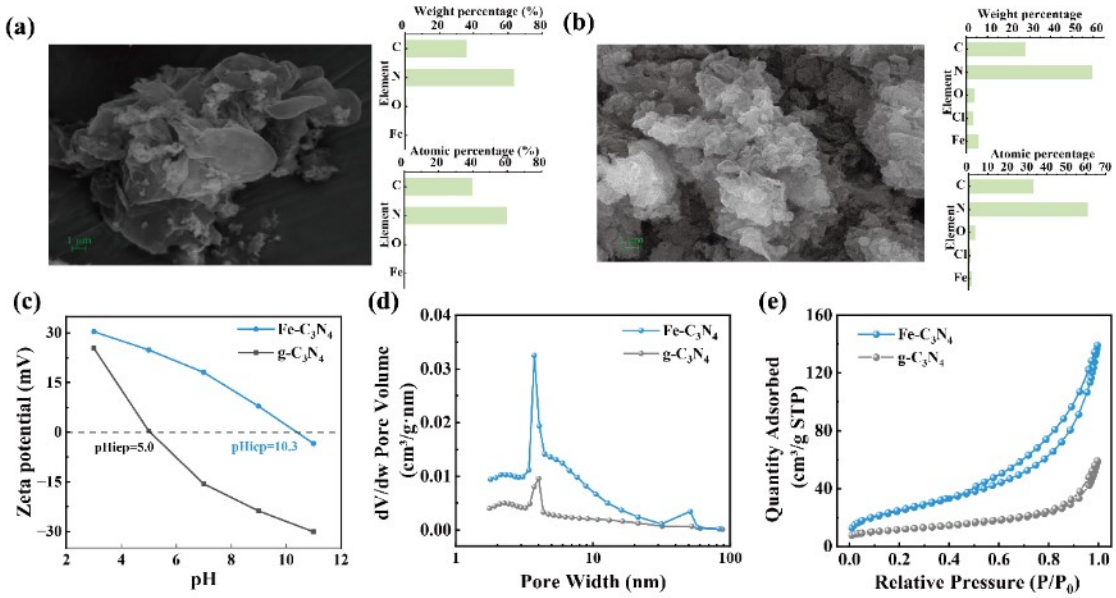

Figure S2. (a) and (b) the SEM of g-C_3N_4 nanosheets and Fe-C_3N_4 and the corresponding elemental compositions. (c) the zeta potential. (d) and (e) the pore size distribution and the adsorption-to-nitrogen isotherm.

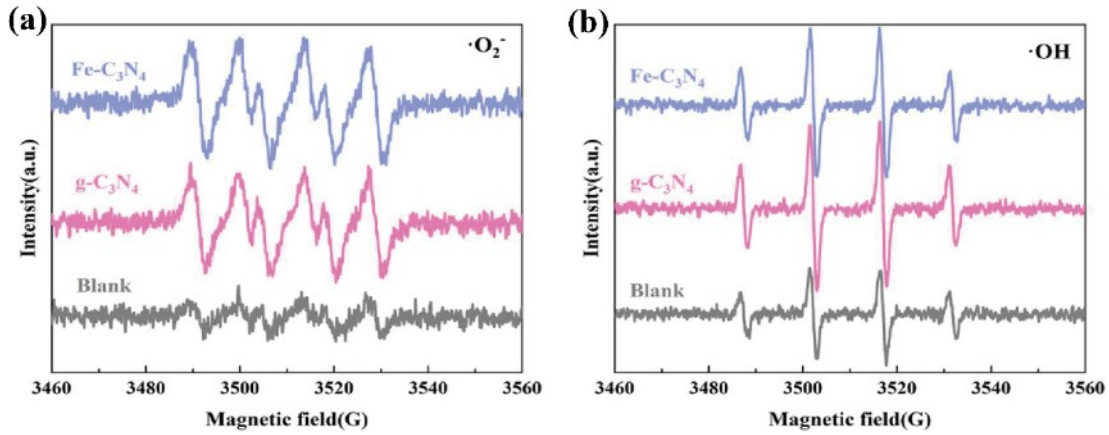

Figure S3. Changes of soil free radicals in each treatment group (a)❿OH, (b) ❿O_2^-

Table S2 The COD of different treatments.

Treatment Number	BF (mg·L^{-1})			TF (mg·L^{-1})			PF (mg·L^{-1})		
	0day	2day	6day	0day	2day	6day	0day	2day	6day
CKU	53.87**a**	267.03**a**	119.79**ab**	78.93**a**	168.53**a**	35.04**a**	29.41**bc**	100.43**a**	23.49**a**
CN-5	53.83**a**	250.40**ab**	128.41**ab**	62.67**a**	106.33**b**	45.94**a**	46.73**a**	83.67**ab**	21.18**a**
CN-20	59.00**a**	205.90**b**	100.61**ab**	65.22**a**	159.87**a**	42.23**a**	33.07**b**	63.67**b**	25.66**a**
FCN-5	57.33**a**	236.23**ab**	142.87**b**	67.13**a**	154.77**a**	45.06**a**	18.41**c**	85.67**ab**	18.74**a**
FCN-20	64.27**a**	218.77**ab**	116.84**a**	80.73**a**	103.23**b**	34.85**a**	40.17**ab**	77.70**ab**	16.84**a**

Table S3 The NH_4^+ of different treatments.

Treatment	BF ($mg \cdot L^{-1}$)		TF ($mg \cdot L^{-1}$)		PF ($mg \cdot L^{-1}$)	
Number	2day	6day	2day	6day	2day	6day
CKU	30.63a	0.63a	19.34a	0.19a	33.30b	0.14b
CN-5	33.57a	0.15a	18.83a	0.38a	36.8ab	0.33a
CN-20	39.91a	0.18a	22.83a	0.23a	47.20a	0.33a
FCN-5	35.70a	0.35a	23.97a	0.66a	31.53b	0.15b
FCN-20	28.20a	0.69a	18.17a	0.25a	27.23b	0.03c

Table S4 The NO_3^- of different treatments.

Treatment	BF ($mg \cdot L^{-1}$)		TF ($mg \cdot L^{-1}$)		PF ($mg \cdot L^{-1}$)	
Number	2day	6day	2day	6day	2day	6day
CKU	0.47bc	0.13a	0.20b	0.14a	0.27a	0.08a
CN-5	0.53ab	0.16a	0.27b	0.17a	0.20a	0.06a
CN-20	0.53ab	0.18a	0.30ab	0.18a	0.23a	0.06a
FCN-5	0.40c	0.23a	0.37ab	0.16a	0.23a	0.08a
FCN-20	0.60a	0.27a	0.47a	0.20a	0.23a	0.07a