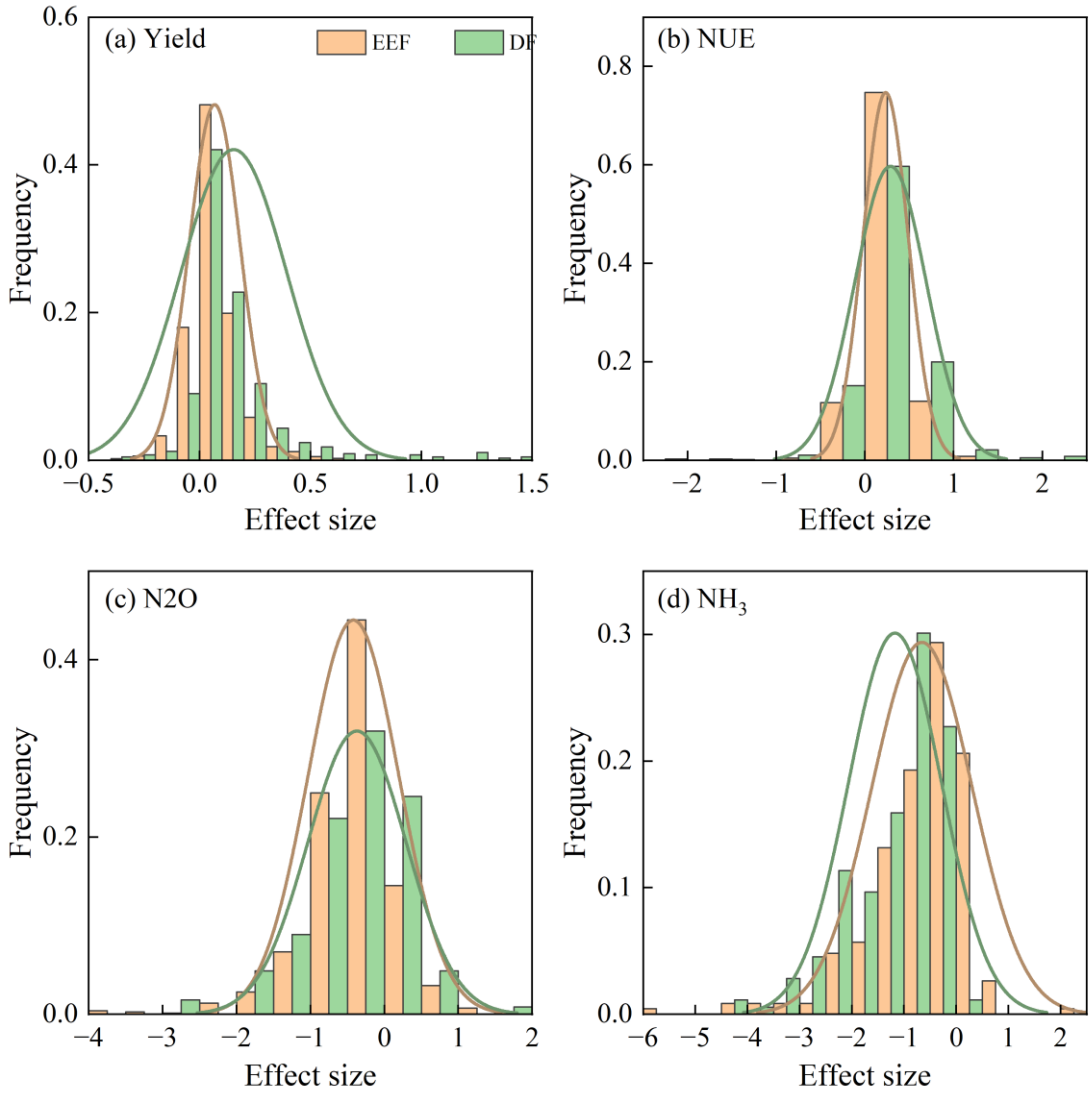

Figure S1

Frequency distribution of the response ratios of (a) yield, (b) nitrogen use efficiency (NUE), (c) N_2O emission, and (d) NH_3 volatilization from using the enhanced efficiency fertilizer strategy and deep fertilization strategy compared with traditional farmers' practices (common urea and shallow fertilization). The solid line represents the fitted normal (Gaussian) distribution of the frequency dataset.

Table S1. Significance of between-group heterogeneity for DF strategy and EEF on yield, NUE, N_2O, yield scaled N_2O emission, NH_3, and yield scaled NH_3 emission.

Variables	P
Yield	0.001
NUE	0.005
N_2O	0.002
Yield scaled N_2O emission	0.828
NH_3	0.001
Yield scaled NH_3 emission.	0.001

Table S2. Significance of between-group heterogeneity for DF strategy and EEF on yield, NUE, N_2O yield-scaled N_2O emission, NH_3, and yield-scaled NH_3 emission under different climate condition groupings.

Climate	Groups	Variables	P	Variables	P
MAP	<400 mm	Yield	0.428	NUE	0.263
	400-800 mm		0.001		0.572
	800-1200 mm		0.001		0.263
	>1200 mm		0.001		0.572
MAP	<400 mm	N_2O	0.262	Yield scaled N_2O emission	
	400-800 mm		0.004		0.008
	800-1200 mm		0.061		0.328
	>1200 mm		0.302		0.152
MAP	<400 mm	NH_3	0.001	Yield scaled NH_3 emission.	
	400-800 mm		0.001		0.631
	800-1200 mm		0.001		0.001
	>1200 mm		0.001		0.001
MAT	<5℃	Yield	0.902	NUE	
	5-10℃		0.784		0.957
	10-15℃		0.001		0.992
	15-20℃		0.061		0.456
	>20℃		0.001		0.433
MAT	<5℃	N_2O		Yield scaled N_2O emission	
	5-10℃		0.001		0.001
	10-15℃		0.001		0.005
	15-20℃		0.001		
	>20℃		0.800		0.051
MAT	<5℃	NH_3		Yield scaled NH_3 emission.	
	5-10℃		0.001		
	10-15℃		0.001		0.708
	15-20℃		0.001		0.001
	>20℃		0.001		0.001

Table S3. Significance of intergroup heterogeneity of DF strategy and EEF on yield, NUE, N_2O, yield-scaled N_2O emission, NH_3, and yield-scaled NH_3 emission under different soil property groups.

Soil properties	Groups	Variables	P	Variables	P
SOC	<10 g kg^{-1}	Yield	0.786	NUE	0.065
	10-20 g kg^{-1}		0.001		0.943
	20-30 g kg^{-1}		0.001		0.001
	>30 g kg^{-1}		0.081		
SOC	<10 g kg^{-1}	N_2O	0.978	Yield scaled N_2O emission	
	10-20 g kg^{-1}		0.298		0.989
	20-30 g kg^{-1}		0.150		0.775
	>30 g kg^{-1}				
SOC	<10 g kg^{-1}	NH_3	0.001	Yield scaled NH_3 emission.	
	10-20 g kg^{-1}		0.001		0.003
	20-30 g kg^{-1}		0.001		0.607
	>30 g kg^{-1}				
pH	<6	Yield	0.001	NUE	0.052
	6-7		0.001		0.136
	7-8		0.024		0.461
	>8		0.970		0.434
pH	<6	N_2O	0.006	Yield scaled N_2O emission	0.037
	6-7		0.002		0.031
	7-8		0.017		0.064
	>8				
pH	<6	NH_3	0.001	Yield scaled NH_3 emission.	0.001
	6-7		0.001		0.458
	7-8		0.001		0.340
	>8		0.004		
TN	<0.7 g kg^{-1}	Yield	0.008	NUE	0.138
	0.7-1.4 g kg^{-1}		0.001		0.526
	1.4-2.1 g kg^{-1}		0.011		0.001
	>2.1 g kg^{-1}		0.001		0.658
TN	<0.7 g kg^{-1}	N_2O	0.001	Yield scaled N_2O emission	
	0.7-1.4 g kg^{-1}		0.205		0.042
	1.4-2.1 g kg^{-1}		0.799		0.066
	>2.1 g kg^{-1}				
TN	<0.7 g kg^{-1}	NH_3	0.001	Yield scaled NH_3 emission.	
	0.7-1.4 g kg^{-1}		0.001		
	1.4-2.1 g kg^{-1}		0.001		0.001
	>2.1 g kg^{-1}		0.016		

Soil texture	coarse	Yield	0.505	NUE	0.119
	medium		0.001		0.009
	fine		0.001		0.002
Soil texture	coarse	N_2O	0.015	Yield scaled N_2O emission	
	medium		0.867		0.372
	fine		0.675		0.014
Soil texture	coarse	NH_3	0.001	Yield scaled NH_3 emission.	
	medium		0.130		
	fine		0.001		0.001

Table S4. Significance of between-group heterogeneity for DF strategy and EEF on yield, NUE, N_2O, yield-scaled N_2O emission, NH_3, and yield-scaled NH_3 emission under different management practice groupings.

Management practices	Groups	Variables	P	Variables	P
Crop species	Rice	Yield	0.011	NUE	0.004
	Maize		0.001		0.332
	Wheat		0.001		0.205
	Oil crop		0.013		
Crop species	Rice	N_2O	0.016	Yield scaled N_2O emission	0.874
	Maize		0.004		0.011
	Wheat		0.040		
	Oil crop				
Crop species	Rice	NH_3	0.001	Yield scaled NH_3 emission.	
	Maize		0.055		
	Wheat		0.001		
	Oil crop				
Nitrogen rate	<150 kg ha^{-1}	Yield	0.001	NUE	0.092
	150-225 kg ha^{-1}		0.001		0.523
	225-300 kg ha^{-1}		0.001		0.006
	>300 kg ha^{-1}		0.089		0.401
Nitrogen rate	<150 kg ha^{-1}	N_2O	0.444	Yield scaled N_2O emission	0.893
	150-225 kg ha^{-1}		0.002		
	225-300 kg ha^{-1}		0.001		
	>300 kg ha^{-1}				
Nitrogen rate	<150 kg ha^{-1}	NH_3	0.002	Yield scaled NH_3 emission.	0.076
	150-225 kg ha^{-1}		0.060		0.821
	225-300 kg ha^{-1}		0.001		0.001
	>300 kg ha^{-1}		0.009		0.001