

Supplementary Material

Table S1. Nutrient Content of Manure and Straw.

Treatment	Type	Measurement time	Input amount (t ha ⁻¹)	water content (%)	Carbon (%)	Nitrogen (%)	Phosphorus (%)	Potassium (%)
M	Pig manure	1991	60	70.0	38.6	2.01	1.29	1.25
		2004	60	69.6	40.2	1.94	2.03	1.74
		2008	60	70.2	31.6	2.56	1.79	1.30
		2012	60	72.9	38.9	1.30	1.20	0.83
MNPk	Pig manure	1991	42	70.0	38.6	2.01	1.29	1.25
		2004	42	69.6	40.2	1.94	2.03	1.74
		2008	42	70.2	31.6	2.56	1.79	1.30
		2012	42	72.9	38.9	1.30	1.20	0.83
NMPS	Wheat straw	1991	1.72	-	41.9	0.67	0.09	1.85
		2004	1.30	-	41.9	0.44	0.04	1.96
		2007	0.75	-	41.9	0.38	0.10	1.29
		2012	0.60	-	41.9	0.72	0.11	2.22
	Corn straw	1991	1.34	-	42.7	1.04	0.24	1.98
		2004	1.02	-	42.7	0.99	0.28	1.84
		2009	1.25	-	42.7	1.43	0.23	2.25
		2012	0.57	-	42.7	0.96	0.33	1.96

M, manure ; MNPk, manure, nitrogen, phosphorus and potassium; NPkS, nitrogen, phosphorus, potassium, straw.

Table S2. Soil Olsen P profile in 2001(mg kg⁻¹).

Depth(cm)	Treatment		
	CK	M	MNPk
0-20	3.56	83.6	91.05
20-40	2.39	2.6	59.61
40-60	2.44	1.32	12.3
60-80	1.94	0.83	13.79
80-100	0.28	0.65	0.97
100-120	0.25	0.63	0.69
120-140	0.64	0.75	0.81
140-160	0.76	0.48	0.87
160-180	0.31	3.25	0.81
180-200	0.75	0.44	2.09

CK, no fertilizer; M, manure ; MNPk, manure, nitrogen, phosphorus and potassium.

Table S3. Crop yield (kg ha⁻¹).

Year	Treatment	Wheat		Corn	
		Average grain yield	Average straw yield	Average grain yield	Average straw yield
1990-2000	NPK	1704	4198	3690	3907
	NPKS	1841	4821	3980	4021
	M	1066	2788	3749	3696
	MNPK	1580	3821	4609	4290
2001-2010	NPK	884	1303	2928	2320
	NPKS	574	1157	2308	1993
	M	1596	3050	4187	4022
	MNPK	1840	3430	5552	5135
2011-2018	NPK	532	1425	1464	1378
	NPKS	503	1463	1143	1523
	M	1158	3291	4077	3496
	MNPK	1382	4171	5488	4892

Table S4. Physical properties and chemical properties (2018) in red soil.

Treatment	TP (g kg ⁻¹)	Olsen P(mg kg ⁻¹)	SOC(g kg ⁻¹)	TN (g kg ⁻¹)	AN (mg kg ⁻¹)
NPK	1.14	74	11.3	1.18	93.4
NPKS	1.13	82.9	10.4	1.13	85.2
M	1.65	183.7	13.9	1.59	108.4
MNPK	2.07	198.1	13.6	1.46	108.5
Treatment	TK (g kg ⁻¹)	AK (mg kg ⁻¹)	pH	BD (g cm ⁻³)	
NPK	14.4	212.2	4.23	1.13	
NPKS	13.8	268.7	4.28	1.19	
M	14.5	205.5	6.73	1.43	
MNPK	13.9	338.5	5.91	1.38	

TP is total phosphorus, Olsen P is available P by Olsen method, SOC is soil organic carbon, TN is total nitrogen, AN is available nitrogen, TK is total potassium, AK is available potassium, BD is bulk density.