Supporting online material

Maize productivity dynamics in response to mineral nutrient additions and legacy organic soil inputs of contrasting quality

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Analysis of abscisic acid in plant biomass

During grain-filling, maize tissue samples from the field trials were taken for abscisic acid (ABA) analysis, a plant water-stress hormone. Abscisic acid (ABA) analysis is commonly used as a direct measurement of plant-water stress. Abscisic acid measurements are only valid for comparison within one genotype (Quarrie and Jones, 1976; Quarrie et al., 1997) as applied here. Vials were filled with cold 80% ethanol and transported to the field sites in a cooler. Five randomly selected tissue samples were taken from one plant, five randomly selected plants were chosen per plot for a total of 25 samples per plot. Tissue samples were taken using a paper hole-punch. The hole-punch was cleaned with ethanol between plants. The tissue samples were transported in coolers and placed immediately into refrigeration. The vials were evaporated in ovens at 105°C for transportation to Cornell University. The ABA was dissolved in 15 mL of 80% ethanol and ABA concentrations were determined following the enzyme-linked immunosorbent assay (Daie and Wyse, 1981).

Supplementary Table S1.

Soil phosphorus (P) pools and mineral nitrogen (Nmin) at different ages of conversion before fertilizer application.

Conversion	Resin	NaHCO$_3$		NaOH		P_A	Sum P	Nmin
	P_i	P_i	P_o	P_i	P_o			
	(kg ha^{-1})							
Young	20	14	41	85	242	75	402	74
Medium	16	10	31	71	182	57	311	32
Old	14	12	22	50	175	48	273	13

Conversion = age of conversion from primary forest to agriculture: young cleared in 2000, medium cleared in 1985, old cleared between 1970-1900; samples taken in 2004. Pi = inorganic P; P_o = organic P; P_A = plant available P (Resin P_i + NaHCO$_3$ P_i + NaHCO$_3$ P_o). Sum P = Resin + NaHCO$_3$ + NaOH. Nmin = (NH_4-N + NO_3-N) extracted by 2N KCl. Different letters within the column indicate significant differences between the means of the conversions at $P < 0.05$. Data from Ngoze (2008).

Supplementary Table S2.

Soil effective cation exchange capacity (CEC_{eff}), potential cation exchange capacity (CEC_{pot}, at pH 7), base saturation (BS), SOC and pH (N=3).

Conversion	BS (%)	pH_{water} (1:2.5)	CEC_{eff} ($mmol_c$ kg^{-1})	CEC_{pot} ($mmol_c$ kg^{-1})	SOC (g kg^{-1})
Young	99.6	6.3	235.0	320.3	59.9
Medium	70.2	5.2	47.3	170.2	32.6
Old	97.2	5.7	102.2	224.2	21.5

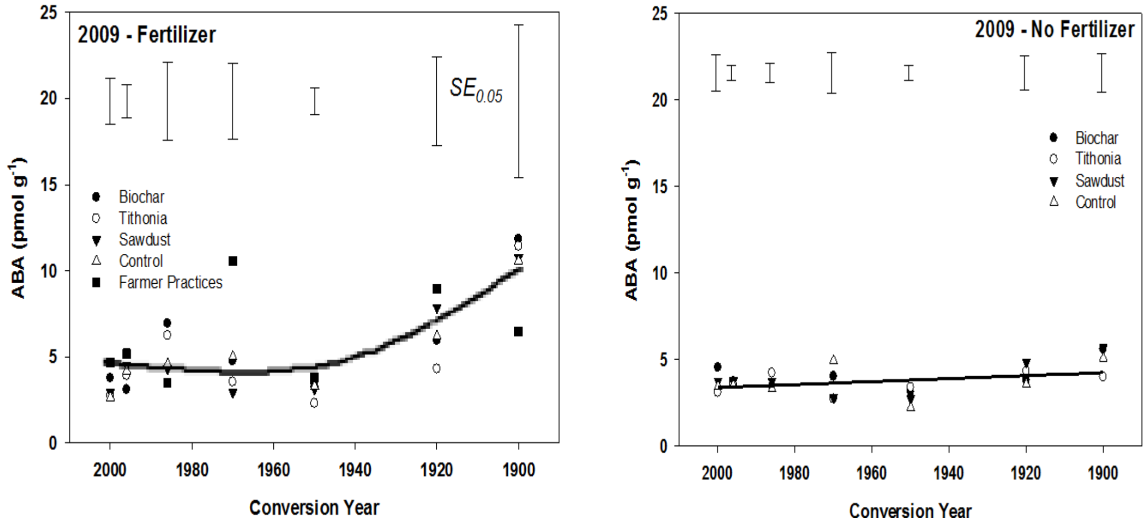
Conversion = age of conversion from primary forest to agriculture: young cleared in 2000, medium cleared in 1985, old cleared between 1970-1900; samples taken in 2005. Data from Kimetu et al. (2008).

Supplementary Table S3.

Properties of organic amendments (expanded from Kimetu et al., 2008).

Treatment	C ($g\ kg^{-1}$)	N ($g\ kg^{-1}$)	C-to-N ratio ($g\ g^{-1}$)	pH in water	Macro-nutrients ($g\ kg^{-1}$)			
					P	K	Ca	Mg
Biochar	851	2.2	387	9.4	0.3	2.7	9.8	1.6
Sawdust	490	1.1	446	5.2	0.1	0.4	1.5	0.1
T. diversifolia	445	48	9	8.4	3.1	35.4	23.4	3.1

nd not determined



Supplementary Fig. S1. Abscisic acid (ABA) concentration in maize tissue as influenced by farm conversion age, fertilization, and organic input quality (methods see supplementary data). Data is from three sampling dates taken during early, mid, and late grain-filling stages for the long-rains of 2009. Regression is calculated for control plots. Bars represent standard error ($P < 0.05$, $N = 9$).

References

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