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Supplement of

Smallholder African farms in western Kenya have limited greenhouse gas fluxes

D. E. Pelster et al.

Correspondence to: D. E. Pelster (d.pelster@cgiar.org)

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Tables:

Table 1. List of *in situ* empirical studies of greenhouse gas fluxes from agricultural systems in sub-Saharan Africa

Reference	Location	Number of sites	Time of measurement	Sampling frequency	Flux rates ⁴
(Baggs et al., 2006)	Kenya	1	Feb – June 2002	Weekly	N ₂ O: 0.2 – 0.6 kg ha ⁻¹ CO ₂ : 1.8 – 2.3 Mg ha ⁻¹ CH ₄ : 0.1 – 0.3 kg ha ⁻¹
(Brümmer et al., 2008)	Burkina Faso	4	June – Sept 2005 April – Sept 2006	1 – 3X per week	N ₂ O: 0.19 – 0.67 kg ha ⁻¹ a ⁻¹
(Brümmer et al., 2009)	Burkina Faso	4	June – Sept 2005 April – Sept 2006	1 – 3X per week	CO ₂ : 2.5 – 4.1 Mg ha ⁻¹ a ⁻¹ CH ₄ : -0.67 - -0.7 kg ha ⁻¹ a ⁻¹
(Chapuis-Lardy et al., 2009)	Madagascar	1	Nov 2006 – April 2007	Weekly	N ₂ O: 0.3 kg ha ⁻¹
(Chikowo et al., 2004)	Zimbabwe	1	Dec 2000 – Feb 2001	Weekly	N ₂ O: 0.1 – 0.3 kg ha ⁻¹
(Dick et al., 2008) ¹	Mali	3	Jan 2004 – Feb 2005	Monthly	N ₂ O: 0.9 – 1.5 kg ha ⁻¹ a ⁻¹
(Hickman et al., 2015) ¹	Kenya	1	Mar 2011 – July 2011 Apr 2012 – Jan 2013	Daily to weekly	N ₂ O: 0.1 – 0.3 kg ha ⁻¹ a ⁻¹
(Kimetu et al., 2007)	Kenya	1	4 weeks	3X per month	N ₂ O: 1.3 – 12.3 µg m ⁻² h ⁻¹
(Koerber et al., 2009) ²	Uganda	24	July 2005 – Sept 2006	Monthly	CO ₂ : 30.3 – 38.5 Mg ha ⁻¹ a ⁻¹
(Lompo et al., 2012) ³	Burkina Faso	2	Mar 2008 – Mar 2009	2X per day	N ₂ O: 80.5 – 113.4 kg ha ⁻¹ a ⁻¹ CO ₂ : 22-36 Mg ha ⁻¹ a ⁻¹
(Makumba et al., 2007)	Malawi	1	Oct 2001 – Apr 2002	Weekly	CO ₂ : 2.6 – 7.8 Mg ha ⁻¹ a ⁻¹
(Mapanda et al., 2010) ²	Zimbabwe	12	Nov 2006 – Mar 2007	2X per month to 1X per 2 months	N ₂ O: 1.0 – 4.7 µg m ⁻² h ⁻¹ CO ₂ : 22.5 – 46.8 mg m ⁻² h ⁻¹ CH ₄ : -9.4 - +6.9 µg m ⁻² h ⁻¹
(Mapanda et al., 2011) ²	Zimbabwe	2	Nov 2006 – Jan 2007 Nov 2007 – Apr 2008 Nov 2008 – Apr 2009	1X per 2 months	N ₂ O: 0.1-0.5 kg ha ⁻¹ CO ₂ : 0.7 – 1.6 Mg ha ⁻¹ CH ₄ : -2.6 - +5.8 kg ha ⁻¹

(Predotova et al., 2010) ²	Niger	3	Apr 2006 – Feb 2007	2X per day for 6 days (repeated 8 - 9X per year)	N ₂ O: 48 – 92 kg ha ⁻¹ a ⁻¹ CO ₂ : 20 – 30 Mg ha ⁻¹ a ⁻¹
(Sugihara et al., 2012) ²	Tanzania	2	Mar 2007 – June 2010	1 – 2X per month	CO ₂ : 0.9 – 4.0 Mg ha ⁻¹ a ⁻¹
(Thomas, 2012)	Botswana	2	Feb, April, July, Nov 2010	7X per day; 12 separate days only	CO ₂ : 1.1 – 42.1 mg m ⁻² h ⁻¹

¹ Study includes fertilization up to 200 kg N ha⁻¹

² Sampling is too infrequent for accurate estimates of cumulative fluxes (Barton et al. in press)

³ Uses photoacoustic spectroscopy, which has recently had questions raised about its accuracy (Iqbal et al., 2013; Rosenstock et al., 2013a)

⁴ Note: flux rates are given as N- N₂O, C- CO₂ and C- CH₄

Table 2: Soil properties (± 1 SEM) for the different land classes

Land class	C content (%)	N content (%)	CN ratio	pH	Bulk Density ($\text{m}^3 \text{m}^{-3}$)
(1) Lowland small mixed farms with degradation signs	1.38 ± 0.13	0.10 ± 0.01	13.18 ± 0.51	6.61 ± 0.09	0.86 ± 0.03
(2) Lower slopes, moderate sized mixed farms with degradation signs	1.18 ± 0.14	0.10 ± 0.01	11.60 ± 0.58	6.58 ± 0.16	1.14 ± 0.08
(3) Mid-slopes, moderate sized grazing land	2.27 ± 0.37	0.18 ± 0.03	12.16 ± 0.42	6.02 ± 0.21	0.98 ± 0.07
(4) Upper slopes/highland plateau, mixed farms	2.67 ± 0.17	0.21 ± 0.02	12.69 ± 0.52	5.46 ± 0.24	0.80 ± 0.06
(5) Mid-slopes, isolated moderate sized farms	2.83 ± 0.36	0.24 ± 0.02	13.02 ± 0.81	5.84 ± 0.20	0.71 ± 0.04

Table 3: Comparison of mean (± 1 SEM) cumulative CO₂-C, CH₄-C and N₂O-N fluxes for four weeks during the dry season (February 2014) and rainy season (April 2014) for differently managed sites in western Kenya.

GHG	Dry Season		Wet Season		P values		
	Annual Crop	Other	Annual Crop	Other	Season	Management ¹	Interaction
CO ₂ -C (g m ⁻²)	19.4 \pm 2.8	20.0 \pm 3.8	76.6 \pm 5.0	62.7 \pm 5.7	< 0.0001	0.393	0.204
CH ₄ -C (mg m ⁻²)	-7.4 \pm 4.4	2.2 \pm 6.7	-3.7 \pm 3.6	-15.0 \pm 3.5	0.610	0.873	0.044
	Fertilized	Not Fertilized	Fertilized	Not Fertilized			
N ₂ O-N (mg m ⁻²)	0.52 \pm 0.23	1.44 \pm 0.40	9.87 \pm 4.23	5.35 \pm 1.14	< 0.0001	0.562	0.112

¹ Management refers to ploughing versus no ploughing for the CO₂ and CH₄ and to fertilized versus no fertilizer for the N₂O