Supplemental materials

Table S1 Estimation of greenhouse gas emissions [1, 2]

Source	Emission factor (EF, kg kg^{-1})			fraction of	Emission (CO_2 eq kg ha^{-1})				
	N	P_2O_5	K_2O	N lost (%)	CK	OM	NPK	NPK-H	NPKOM
Production	8.21 [3]	0.73 [2]	0.50 [2]	/	0	0	2217	4434	1108
Transport	0.09 [3]	0.06 [2]	0.05 [2]	/	0	0	38	75	19
Direct N_2O									
Chemical N	0.0175 [4]	/	/	/	0	0	2049	4098	1024
Organic N	0.0261 [4]	/	/	/	0	3813	0	0	1919
Indirect N_2O									
Leaching	0.011 [1]	/	/	14.53 [5]	0	234	187	374	211
Runoff	0.011 [1]	/	/	8.20 [6]	0	132	106	211	119

GHG (CO_2 equivalent) generated from the production (GHG_{Pr}) and transportation (GHG_{Tr}) of chemical fertilizers:

$$\mathrm{GHG_{Pr}\ or\ GHG_{Tr}} = \sum_{i=N,P,K}^{3} \mathrm{EF_i} \times F_i \quad (1)$$

The direct emission of N_2O (dE_{N2O}) from the application of chemical and organic N fertilizers:

$$\mathrm{dE_{N2O}} = \sum_{i=organic\ N,chemical\ N}^{2} \mathrm{EF_i} \times F_{Ni} \quad (2)$$

The indirect N_2O emissions (idE_{N2O}) caused by the application of N fertilizers:

$$\mathrm{idE_{N2O}} = \mathrm{F_N} \times (14.53\% + 8.20\%) \times 0.011 \quad (3)$$

Conversion of direct and indirect emission of N_2O (dE_{N2O}) to CO_2 equivalent greenhouse gas emission (GHG_{FN}):

$$\mathrm{GHG_{FN}} = (\mathrm{dE_{N2O}} + \mathrm{idE_{N2O}}) \times \frac{44}{28} \times 298 \quad (4)$$

The total emission (GHG) from production, transportation and application of fertilizer:

$$\mathrm{GHG_A} = \mathrm{GHG_{Pr}} + \mathrm{GHG_{Tr}} + \mathrm{GHG_{FN}} \quad (5)$$

Conversion to yield and profit scaled $\mathrm{GHG_Y}$ and $\mathrm{GHG_P}$:

$$\mathrm{GHG_Y} = \mathrm{GHG_A} \div \mathrm{Yield} \quad (6)$$

$$\mathrm{GHG_P} = \mathrm{GHG_A} \div \mathrm{Profit} \quad (7)$$

References

1. Hergoualc'h, K.; Akiyama, H.; Bernoux, M.; Chirinda, N.; del Prado, A.; Kasimir, Å.; MacDonald, J.D.; Ogle, S.M.; Regina, K.; van der Weerden, T.J. N_2O emissions from managed soils, and CO_2 emissions from lime and urea application. In, *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Agriculture, Forestry and Other Land Use,* Calvo Buendia, E., Tanabe, K., Kranjc, A., Baasansuren, J., Fukuda, M., S., N., Osako, A., Pyrozhenko, Y., Shermanau, P., Federici, S., Eds.; The Intergovernmental Panel on Climate Change: Switzerland, 2019; Volume 4.
2. Forster, P.; Ramaswamy, V.; Artaxo, P.; Berntsen, T.; Betts, R.; Fahey, D.W.; Haywood, J.; Lean, J.; Lowe, D.C.; Myhre, G.; et al. Changes in Atmospheric Constituents and in Radiative Forcing. In, *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change,* Solomon, S., Qin, D., Manning, M., Chen, Z., Marquis, M., Averyt, K.B., M. Tignor, Miller, H.L., Eds.; Cambridge University Press: Cambridge, United Kingdom and New York, NY, USA., 2007.
3. Zhang, W.F.; Dou, Z.X.; He, P.; Ju, X.-T.; David, P. New technologies reduce greenhouse gas emissions from nitrogenous fertilizer in China. Proc. Natl. Acad. Sci. U. S. A. 2013, 110, 8375–8380, doi:10.1073/pnas.1210447110.
4. Wang, Y.; Yao, Z.; Pan, Z.; Wang, R.; Yan, G.; Liu, C.; Su, Y.; Zheng, X.; Butterbach-Bahl, K. Tea-planted soils as global hotspots for N2O emissions from croplands. Environ. Res. Let. 2020, 15, 104018, doi:10.1088/1748-9326/aba5b2.
5. Zheng, S. Study on the monitoring methods of nitrate leaching and features of nitrogen leaching in tea plantation. Chinese Academy of Agricultural Sciences, Beijing, 2022.
6. Xie, S.; Feng, H.; Yang, F.; Zhao, Z.; Hu, X.; Wei, C.; Liang, T.; Li, H.; Geng, Y. Does dual reduction in chemical fertilizer and pesticides improve nutrient loss and tea yield and quality? A pilot study in a green tea garden in Shaoxing, Zhejiang Province, China. Environ. Sci. Pollut. Res. 2019, 26, 2464-2476, doi:10.1007/s11356-018-3732-1.