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Farmers’ and academia’s views”

Effect of soil management practices on soil carbon dynamics under maize cultivation

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Abstract

An increasing world population and change in consumer preferences necessitate the need to increase food production to meet the demand of a changing world. Intensified agriculture and an accelerated climate crisis with increasing weather extremes threaten the resource base needed to improve crop production. Maize yield obtained by farmers in the guinea savannah zone of Ghana is generally low due to low soil fertility status resulting from continuous cropping coupled with low use of external inputs. Integrated Soil Fertility Management (ISFM) practices have proven to sustainably increase maize yield. However, majority of the farmers practicing ISFM till their land conventionally, potentially resulting in substantial greenhouse gases (GHG) emissions that contribute to global climate change. However, there is dearth of information on GHG emissions regarding crop production systems in sub-Saharan Africa in general and Ghana in particular. Hence, within a field trial we seek to investigate the impact of different tillage practices and ISFM applied to sustain maize yield, on net CO₂ or ecosystem exchange (NEE) and net carbon (C) balance (NECB). The field trial was established in Northern region of Ghana. A split plot design was used with the main plot treatments being conventional tillage and reduced tillage and the subplot treatments being factorial combination of organic and inorganic fertilisers at three levels each. To determine NEE and thereon based estimates of NECB, an innovative, customized, low-cost manual, dynamic closed chamber system was used. CO₂ concentration increase and decrease over chamber deployment time was detected by portable, inexpensive Arduino based CO₂ logging systems, consisting of a battery powered microcontroller (Arduino Uno) connected to an NDIR-CO₂ sensor (SCD30; ± 30 ppm accuracy), air temperature and humidity (DHT-22) as well as air pressure sensor (BMP280). Measured CO₂ fluxes were subsequently gap-filled to obtain seasonal NEE. C import and export were further on added to NEE to determine the NECB for each treatment. In parallel to CO₂ exchange measurement campaigns, agronomic and crop growth indices such as the normalised difference vegetation index were performed biweekly at all plots. Here we present NEE and NECB balances for the first crop growth period.

Keywords: CO₂ emission, integrated soil fertility management, net ecosystem carbon balance, tillage, *Zea mays*