Decomposition and Mineralization of Some Organic Residues in two Contrasting Agro-Ecological Zones in Ghana

Dodobi Martin Tetteh
University of Ghana, 2018

Abstract

Decomposition and mineralization from plant and animal residues are important processes that can improve soil fertility and build–up soil organic matter. Decomposition and mineralization of 5 and 10 t/ha of matured cow dung (CD) in Ada soil series of the coastal savannah agro-ecological zone, as well as 5 and 10 t/ha of artisanal empty fruit bunch (EFB-AT) and industrial empty fruit bunch (EFB-IN) in Kokofu soil series of the semi-deciduous forest agro-ecological zone were studied using pots. The objective of the study was to assess the decomposition and nutrient release patterns of manured CD and EFB-AT and EFB-IN in order to give an estimate of the release patterns and to synchronize the nutrient release to meet the nutrient demands of crops. The study was conducted between February and June 2017. The dry CD at the two application rates were used for the study in Ada soil series, classified as Entisols (USDA classification) by Brammer (1960), which corresponds to Fluvisols under FAO (1970) classification. Also dry EFBs were used for the Kokofu soil series which are classified Ultisols USDA (Brammer, 1960). Dry CD was put in nylon litter bags, and was buried at 8 cm deep in the soil (in the pots) as practiced by farmers in the Sege area, where CD is incorporated into the soil on application. Chopped EFBs of 2cm mesh size were put in nylon litter bags, and placed on the surface of soil in the pots as practiced by farmers in the Kade area, where EFBs are placed on the soil surface in most oil palm plantations to serve as mulch. The EFB samples were taken from artisanal palm oil producers (EFB-AT) and industrial palm oil producers (EFB-IN). Buried CDs in pots were sampled at 7, 14, 21, 35, 56, 72 and 90 days whiles EFB-AT AND EFB-IN were sampled 7, 14, 21, 35, 56, 72 90,120 and 150 days after being placed on soil surface in pots. Sixty percent (60%) of the initial weight of the CD decomposed within 90 days with no significant difference (t=0.05) in the fractions lost between 5 and 10t/ha by test analysis, based on pair comparison. In the case of EFB-AT, about 20% of the 5 t/ha and 50% of 10 t/ha, of the initial weight had decomposed over the 150 days period. For EFB-IN about 78% of the 5 t/ha and 75% of the 10t/ha of the initial weight decomposed over the 150 days period. Comparatively, a t-test analysis, based on pair comparison, showed a significant difference (t=0.08) between the fractions lost by EFB-AT and EFB-IN at the two application levels. The estimated half-life (t ½) for the decomposition of CD were 82 and 99 days for 5 t/ha and 10 t/ha, respectively. For EFB-AT, the estimated half-life were 112 and 130 days for 5 and 10 t/ha, respectively, while for EFB/IN half-life was 83 and 87 days for 5 and 10 t/ha, respectively. Approximately between 10 and 20% of the initial TN content of the CD was released during the 90 days period with significant difference (t=0.07) in the fractions released between 5 and 10t/ha of CD. Similarly, approximately 15-20% of the initial TN of the EFB-AT and between 30 and 38 % of TN in EFB-IN was released during the 150 days period. Based on pair comparison, the difference in the TN released between EFB-AT and EFB-IN was significant (t=0.07) even between the two application rates (5and10t/ha). Between 30-38% of the initial P content of the CDs was released while about 60% of the EFBs was released with significant difference (t=0.06) in the fractions released between 5 and 10t/ha, and between EFB-AT and EFB-IN. About 90% of the initial K content in EFBs was released while about 40-50% of the initial K content of the CDs was released during the experimental period,

with significant difference (t=0.07) in the fractions of K released between 5 and 10t/ha CD and between EFB-AT and EFB-IN.

Key words: Decomposition; Mineralization; Organic residue; Cow dung; Empty fruit bunch.

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