

Effect of Topsoil Stockpiling and Organic Amendments on Soil Properties and Tree Growth during Gold Mine Reclamation in Ghana¹

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Abstract: Topsoil is a valuable resource and regarded as the most critical and key element in any successful revegetation following mining activities. Salvaging and stockpiling topsoil and reserving it for future reclamation is thus, often encouraged in mine operations. Studies have, however, demonstrated topsoil stockpiling to have major adverse impacts on soil properties and that stockpiled topsoil would require organic amendment to improve its properties to promote plants' growth. This study was therefore undertaken with the hypothesis that (a) topsoil stockpiling at Newmont Ghana Gold Limited³ will cause significant adverse impacts on soil properties and (b) amendment of stockpiled topsoil with organic materials like composted sewage sludge and poultry layer manure will significantly promote survival and growth of planted trees. A waste-rock dump measuring 36m by 45m was graded and covered with 70 cm layer of stockpiled subsoil followed by 30 cm layer of stockpiled topsoil. Soil samples, with three replicates, were randomly collected from the site and that of a nearby un-mined site as reference, for determination of pH, nutrients, OM, EC, ECEC, base saturation, bulk density and texture. Poultry layer manure, composted sewage sludge, and no amendment (control) were applied as treatments. Potted-seedlings of five forest tree species were planted in May 2016, followed by application of amendment materials. Diameter and height of all planted trees and number of surviving trees were twice taken to determine tree growth and survival. Statistical analysis revealed that topsoil stockpiling did not have any significant adverse impact on the assessed soil properties, compared with the reference. One-way ANOVA combined with LSD and Duncan post-hoc tests ($\alpha = 0.05$) also indicated there was no significant influence of organic amendment on tree growth. Competition from herbaceous plants and lack of weed control were observed to be the main driving factors hindering survival and growth of planted trees. Planting the intended tree species concurrently with ground cover species in the first growing season combined with adequate weed control are perceived to promote tree growth and survival at the site, rather than application of organic amendments.³

Additional Key Words: topsoil, mine-reclamation, organic amendment, revegetation, soil properties, trees

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3. Work reported here was conducted at Newmont Ghana Gold Limited mine operation at Ahafo-Kenyase, located between latitudes 6°40" and 7°15" North and Longitudes 2°15" and 2°45" West.