

## Shear strength and root length density analyses of Entisols treated with palm oil mill effluent sludge

### ABSTRACT

The underutilized and improper management of wastewater such as palm oil mill effluent sludge (POME) sludge might create pollution and give a negative impact towards the environment. This study was aimed to evaluate the effect of shear strength parameter and root length density of maize on Entisols applied with POME sludge as a soil amendment. The maize was planted on Rasau soil series (Entisols) amended with different POME sludge treatment systems from various ponds (mixing, anaerobic, facultative, algae, and dumping). Standard direct shear box test was used to identify the cohesion ( $c$ ) and angle of internal friction ( $\phi$ ) after application of treatments. The bulk density, porosity, moisture content, organic matter, root length and root density of *Zea mays* L. (Hibrimas) applied with POME sludge from dumping pond (DP), algae pond (ALP) and facultative pond (FP) were significantly difference against the control treatment. The positive effect of root length and root length density (RLD) treated with POME sludge from the dumping pond was 26% and 38% compared to the other treatments. The results highlighted that roots enhanced soil shear strength by reducing the cohesion and increased the angle of internal friction component. The shear strength analysis showed that high shear strength of normal stress at  $500.72 \text{ kN/m}^2$  was measured from the dumping pond's POME sludge treatment after maize harvesting. The POME sludge from the DP, ALP and FP was ameliorating some nutrients deficiencies for the plant growth and improved the root length density. In conclusion, the POME sludge from the DP indicated the high shear strength and root length densities due to the adequate nutrients for roots distribution and maize growth.

**Keyword:** Shear strength; Root length density; Entisols; POME sludge