

Orapin Kliaklom 2010: Properties of Plough Pan in Cassava and Sugarcane Growing Soils, Khon Kaen Province. Master of Science (Soil Science), Major Field: Soil Science, Department of Soil Science. Thesis Advisor: Miss Suphicha Thanachit, Ph.D. 145 pages.

A study on agricultural limitation of plough pan, which is likely to affect the growth of cassava and sugarcane, comprised the analyses of morphological, physical and chemical properties of plough pan bearing soils and the measurement of soil resistance. Five areas studied included Satuk, high base subsoil variant (PP-1; Ultic Haplustalf), Phonphisai, sandy variant (PP-2; Typic Plinthustult), Yasothon soils series (PP-3; Typic Haplustult), and Satuk soil series (PP-4, PP-5; Typic Paleustults), all located in Khon Kaen province. They were deep soils, having gap graded distribution with the texture ranging from loamy sand to sand clay loam. The soils were extremely acid to neutral (pH 4.4-6.8) with low fertility and cation exchange capacity ($0.5-6.8 \text{ cmol kg}^{-1}$) levels.

Plough pan was found in all soils except Phonphisai, sandy variant soil. The pans formed at depths of 20-25 cm from soil surface with approximate thickness of 15-20 cm. Bulk density ($1.69-1.85 \text{ Mg m}^{-3}$) and strength ($0.3-3.3 \text{ kg cm}^{-2}$) of plough pan were higher than that of the topsoil and layer directly below the pan but porosity (30.1-36.2%), saturated hydraulic conductivity ($0.04-1.21 \text{ cm hr}^{-1}$) and available water capacity (4.95-7.63% by volume) were lower. However, plant nutrient and organic matter contents in these compacted layers were indifferent from subsoils but lower than that in the topsoil.

Penetrometer resistance in cassava and sugarcane growing soils ranged between 2-8 and 3-10 MPa, respectively and the values were higher than 6 MPa at the soil surface in some areas. Depths of plough pan found in cassava growing areas, approximately at 10 cm from the surface, were shallower than those of sugarcane growing soils (20 cm). Physico-chemical properties of plough pan in the areas of growing both crops were quite similar. Bulk density values in plough pan ($1.70-1.83 \text{ Mg m}^{-3}$) under cassava cultivated soils were higher than those under the use for growing sugarcane ($1.56-1.80 \text{ Mg m}^{-3}$), which was in contrast to soil strength that the former soils had higher values ($0.43-2.79 \text{ kg cm}^{-2}$) than did the latter soils ($0.28-6.87 \text{ kg cm}^{-2}$). In addition, the amounts of root distribution in these layers were clearly lower than that in the topsoils.

Plough pan had some properties that slightly severely limited the growth of both plants. High bulk density can restrict root penetration. Slow saturated hydraulic conductivity retards up and down movement of water, which results in the reduction of available water during drought season due to the impediment of capillary rise. Water runoff can be accumulated after the rain pelt, which in turn, increases the risk of soil erosion, especially in the sloping areas. Plough pan, however, has no effect on plant nutrient accumulation on the top of the layer.

Student's signature

Thesis Advisor's signature