NOTES

CHANGES IN CHEMICAL PROPERTIES OF HEAPED SOIL IN A TROPICAL REGION

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Soil development is seen as the development of soil properties as functions of climate, organisms, relief, parent material and time (Jenny 1941). Time zero for soil development is the point in time at which a pedologically catastrophic event is completed, initiating a new cycle of soil development (Buol *et al.* 1989). In this meaning the formation of heaped earth could be equated with the commencement of soil development and following changes in soil properties, this could be considered an initial soil development. Changes in chemical properties of a heaped soil in the tropics were examined within one year after heaping.

The study site was at Bukit Soeharto Experimental Forest of Mulawarman University (60 m in altitude, 0°52'S, 117°01'E), East Kalimantan, Indonesia. The climate of the region is classified as "Aafw" in Köppen's system. The geology of the area is characterized by Neogene sedimentary rocks and the soils of the area belong mostly to Typic Paleudults with soil textural variations (Ohta & Effendi 1992a).

Sub-soil was heaped to put out a fire which occurred on 24 September 1991. An investigation plot (10 × 10 m) was set up on the mound and soil samples were collected in December 1991, May and September 1992. Soils at 0 - 5 cm depth sampled from each corner of the plot and four individual samples were analyzed at every occasion.

Measurement of pH(H_2O) was made on 1:2.5 soil-water suspension using a glass electrode. Available nitrogen (AV-N) was estimated by incubating the soil samples for two weeks at 30 °C. Moisture content was maintained at 60% of the maximum water holding capacity. Ammonium N (NH_4N) and nitrogen N(NO_3N) contents were then determined by the method of Bremner (1965). Cation exchange capacity (CEC) was measured using 1 mol l^{-1} ammonium acetate (NH_4OAc) at pH 7 (Peech *et al.* 1947). Exchangeable bases (Ca, Mg, K and Na) in NH_4OAc at pH 7 were determined using the atomic absorption spectrophotometer. Base saturation rate was expressed by the percentage of the sum of exchangeable Ca, Mg, K and Na to CEC.

On December 1991 partial colonization by herbaceous species was observed. However, the mound remained bare in September 1992. There was no visible change of soil properties during the study.

Analytical results are shown in Table 1. There was no significant change of pH and AV-N (NH_4N + NO_3N) during the study. Increase of CEC was observed. Exchangeable bases except Na and base saturation rate decreased. In September 1992 a high content of Na was observed at one sample while values of the other three samples were very low.

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Table 1. Changes in chemical properties of the heaped soil (mean ± SE) (n=4)

Property	Sampling date		
	December 1991	May 1992	September 1992
pH(H_2O)	4.68 ± 0.21	4.45 ± 0.25	4.68 ± 0.12
AV-N mg/100g soil (NH_4N + NO_3N)	4.67	3.57	4.23
NH_4N mg/100g soil	3.27 ± 0.73	1.84 ± 0.34	2.69 ± 0.86
NO_4N mg/100g soil	1.40 ± 0.41	1.73 ± 1.23	1.54 ± 1.08
CEC cmol (+)/kg soil	15.41 ± 0.50	20.29 ± 3.03	21.59 ± 5.66
Ex-K cmol (+)/kg soil	0.44 ± 0.04	0.47 ± 0.03	0.25 ± 0.05
Ex-Ca cmol (+)/kg soil	1.04 ± 0.45	0.95 ± 0.32	0.38 ± 0.26
Ex-Mg cmol (+)/kg soil	0.98 ± 0.28	0.78 ± 0.18	0.27 ± 0.14
Ex-Na cmol (+)/kg soil	0.39 ± 0.13	0.43 ± 0.11	1.20 ± 2.74
Base saturation rate %	18	13	9

Values of pH and AV-N collected in December 1991 were at the same level as those of lower B and C horizons of the soils in the area (Ohta & Effendi 1992b). However, CEC and exchangeable bases contents were greater than those of lower B,C and A horizons of the soils in the area (Otha *et al.* 1993). As the heaped soil was mostly from the lower B and C horizons, high values in CEC indicate that chemical changes rapidly occurred after the heaping. During the study precipitation was relatively constant, around 150 mm per month, amounting to 1830 mm. There was no long dry period, and the driest months were October 1991 (50 mm) and February 1992 (44 mm). Therefore high CEC is assumed to have caused leaching from the exposed mineral fragments. Mineral weathering rather than soil development might have effected the present increase in CEC. Increase in CEC and decrease in bases saturation rate are well known in soil development with time (Bockheim 1980). These signs in this study could be considered as proof of soil development. There was little contribution from vegetation to show any visible sign of soil development during the study. For soil formation 97 years per cm for a solum of an Utisol has been estimated (Buol *et al.* 1989). A long time is required for a site to exhibit any visible characteristic of soil development under natural conditions. In the sense of Jenny (1941), soil development was low during the study. The rate of soil development will be accelerated when organic matter accumulates following the recovery of vegetation.

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A NOTE ON *AZADIRACHTA EXCELSA*: A PROMISING INDIGENOUS PLANTATION SPECIES?

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Azadirachta excelsa, a member of the Meliaceae family, is found naturally in lowland forests from Sumatra to New Guinea including Peninsular Malaysia.

Corner (1988), and Mabberly and Pannell (1989) describe *A.excelsa* as a large evergreen tree that can attain 50 m in height and 4 m girth. Wyatt-Smith (1952) ranks the tree as an intermediate between the emergent and main canopy. In the humid tropics it is generally evergreen but may be deciduous for up to three months under a more seasonal climate.

Ng and Tang (1972) found that *A. excelsa* was one of the fastest growing trees in the arboretum of the Forest Research Institute Malaysia (FRIM).

The timber is moderately hard and moderately heavy. Because of its reddish brown heartwood which darkens on exposure it is likened to the true mahogany (*Swietenia macrophylla,* also belonging to the Meliaceae family) but lacks its low shrinkage and movement (Burgess 1966). The end uses of both timber species are similar. Similarly, the young shoots are eaten as a vegetable, though rather bitter. The old leaves are said to be intensely bitter and used only in medicine. The fruit is edible but little palatable (Corner 1988).

To date this species has not been planted on a large scale. In central and northern Malaya it is a common village tree (Mabberly & Pannell 1989). A few research plots of this species exist in the Bukit Lagong Forest Reserve, Selangor, Peninsular Malaysia. One of them was re-measured recently.