Soil Fertility Assessment and Rehabilitation of Cultivated Red Acid Soil in South Sumatra, Indonesia

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Indonesia is a tropical country that has a problem in deforestation, accelerated change of forest land into cultivated area. During 1990-2000, increasing area including upland area and rice field, decreasing area covered by forest 24,261.069.50 ha (18.37%). This decrease clearly indicated the establishment of plantation agriculture, mainly hard plant commercial commodity such as rubber, timber, coffee and cacao and also illegal logging.

Several changes of soil quality occur when virgin soil is cultivated, many researchers have observed changes of quantitative parameters, such as organic carbon or nitrogen content when trees are removed from land use systems. Anothers problem in Indonesia is intensively agriculture for food crops by chemical fertilizer.

Base on above condition, several research had been conducted at Sumberjaya, West Lampung and Tamanbogo, East Lampung. Sumberjaya is one of the coffee producing center of Lampung is located in mountainous western part of Lampung with elevation around 800m-1200m asl. Soil conservation becomes important due the fact that, there was a rapid change of land use type from forest areas to coffee plantations. The aim of the study was to assess soil fertility by soil biology as affected by deforestation and to rehabilitate soil fertility by cover weed management. Tamanbogo, is one of food crop center of Lampung is located in middle terrace eastern part of Lampung with elevation around 30m-33m asl. Intensively agriculture in this area makes soil unfertile. To remidiate soil fertility in this area, application of indigineous organic resources become important.

To assees soil fertility by soil biology as affected of deforestation, a measurement of earthworm and AMF spore was done in various landuses at February 2001 . The results show that, deforestation in a hilly area Sumberjaya from primary forest to coffee plantation by slash and burn methods decreasing the AMF spore diversity. In the primary forest we found 3 Genera and 7 species of AMF spore, namely Glomus (*G. ettunicatum, G. constrictum* and *G. aggregatum*), Sclerocystis (*Sclerocystis rubiformis*) and Scutelosphora (*Scutelosphora* sp1, and *Scutelosphora* sp2). In Secondary forest, Scutelosphora not found and change with Acaulosphora genera with one species *Acaulosphora tuberculata*. When Primary forest change into deforest area, coffee plantation area and mix farming area, the

diversity of AMF spore were decrease. Only one genus was found, Glomus (*G. etunicatum, G. constrictum* and *G. aggregatum*). In the bush and native grass area we found three genera (Glomus, Sclerocystis, and Acaulosphora) and 7 species AMF spore as like as in secondary forest. Earthworm abundance and diversity not affected by deforestation from primary forest to cultivated area. We found the same family of earthworm in all of landuses i.e. Pheretima and Pontoscolex.

To rehabilitate soil fertility in young coffe plantation, cover weed management was conducted at Sumberjaya district. Experimental plots were established on a hilly area Sumber Jaya (735 m above the sea level),West Lampung Province, South Sumatra Indonesia in October, 2000. Each plot was 2.5 m wide and 30 m long along sharp 60° slope facing the west. Design of plots were as follows: clearing up all grounds weeds in coffee plantation (Control), spot weeding around coffee plant covered with Paspalum conjugatum (P.C. + spot), strip weeding around coffee plant covered with Paspalum conjugatum (P.C. + strip), spot weeding around coffee plant covered with natural weed (N.W.+ spot), and strip weeding around coffee plant covered with natural weed (N.W.+ strip) Six month seedlings of *P. conjugatum* were transplanted in November 2000. The control plot was manually weeded twice a month. Spot weeding in P.C. and N.W. within a diameter of one meter around coffee tree was also performed in twice a month. Strip set up wide 0.5 m along 2 m with P.C. and N.W. at the bottom of coffee tree, respectively . The results show that, the content of soil organic C, total Nitrogen, total P, and available K were higher in coffee plot with covered by weed especially *Paspalum conjugatum* than control plot (no weed cover) and coffee plot covered by native weed.

Weeded treatment both *Paspalum conjugatum* and native weed, increase the earthworm abundance. High number of earthworm was in coffee plot weeded spot than in coffee plot weeded strip, both by *Paspalum conjugatum* and native weed. However, there was no different earthworm biomass among weed cover management. Cover weed management had the same effect on the earthworm biomass.

The AMF spore number was higher in coffee weeded spot both with *Paspalum conjugatum* cover or native weed than other treatment. Furthermore, AMF spore diversity index were high too.

In the middle terrace Tamanbogo, soil fertility rehabilitation by using indigenous organic resources (green manure and chicken manure) had effect on soil chemical, soil biological (AMF spore, earthworm abundance, and enzyme activities) and production of corn and upland rice.

After longterm (3 years) treatment, soil chemical in red acid soil Taman Bogo was change. Soil pH, organic C, and total N, were increase especially by application 100% chicken manure (20 ton ha^{-1}). The highest of soil pH, organic C and total N was in 100% chicken manure plot (6.48, 1.65%, 0.19%, respectively).

The highest number of AMF spore was in a plot that application with 100% chicken manure. Compare with AMF spore species, *G. constrictum* was the highest spore number in all manure treatment. Moreover, the earthworm population and biomass were high too in a 100% application of chicken manure.

In the first year application treatment (in 2001), the corn yield was high in plot receive 50% chicken manure combine with 50% inorganic fertilizer. However, in 2002, upland rice yield was high in chicken manure plot, both of exclusevely and combination with inorganic fertilizer. Moreover, in the last seasons, 2003, the high corn yield was in plot treatment with 100 % chicken manure.