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## Soil Amendments to Re-establish Agricultural Production on Ex-tin Mined Area

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### Abstract

Mining is an important industrial sector in Bangka Island (Indonesia) where about 70% of this area is tin mining. The separation of tin via flotation of tin-containing soils results in acidic nutrient-poor soils with very low organic matter contents. Hence, ex-tin mined areas are highly and unsuitable for plant growth due to their un-fertility. To improve soil fertility soil amendments are of vital importance. This research aims to evaluate the impact of different soil amendments on agricultural production and basic soil parameters on the ex-tin mined area.

The study was conducted on ex-tin mined area located in Bangka Regency, Indonesia (1°47'22.9085 S and 106°5'47.0461 E). Bangka Regency has a tropical climate with an average daily temperature of 27.2°C, precipitation during the growing season is 191.5 mm per month. The field trial was set up in July 2018 by a randomized complete block design with five different soil amendments and control plots for comparison, with a size of 2 x 2 m in four replicates. The treatments consist of the: (1) Control, (2) Lime, (3) Compost; (4) Charcoal and combinations of (5) Charcoal and Compost, and (6) Charcoal and sawdust. The soil was amended with t.ha<sup>-1</sup> for the single amendments (treatments 2-4), and with rate 20 t.ha<sup>-1</sup> for combined amendments (treatments 5 and 6). The plots are used to grow cassava (*Manihot esculenta*) for 12 months as the main crop and *Centrocema pubescens* as used as a cover crop grown twice for 6 months to avoid soil erosion. Soil samples were taken before and after harvest to analyze soil properties. Soil samples were analyzed for the following parameters: pH, Dissolved Organic Carbon (DOC), and Electric Conductivity (EC). Crop yields were determined by weighing the total harvest of each crop per plot. The cover crop was harvested in December 2018, and replanted, until the main crop Cassava was harvested (30 July 2019), where the cover crop yield was also evaluated. Cassava yields were separated into belowground and aboveground yields.

Soil amendments showed positive effects on soil pH, DOC, and EC at harvest time. Lime treatment significantly improved soil pH and EC (7.40 and 72.30  $\mu\text{S}\cdot\text{cm}^{-1}$  respectively), while DOC was

significantly increased by compost treatment. *Centrocema pubescens* yields were significantly higher at the first harvest compared to the second one. The combined treatment with charcoal (10 t.ha<sup>-1</sup>) + Compost (t.ha<sup>-1</sup>) showed significantly the highest yield for both samplings. While another combined treatment, where, charcoal and sawdust was applied at 10 t.ha<sup>-1</sup> each, showed the highest total cassava belowground biomass (5.44 ton.ha<sup>-1</sup>) as well as cassava aboveground biomass (3.06 ton.ha<sup>-1</sup>).

Results of the present field experiment suggest that the application of soil amendments directly affected soil parameters. The effect on yields was positive but crop dependent, likely due to different nutrient requirements. Data on heavy metal uptake by plants regarding soil amendments will be presented. Soil amendments can provide the potential to improve food safety and security in the ex-tin mined area.

Keywords: ex-tin mined, soil fertility, soil amendments, soil parameters, crop yields