Evaluation of Some Leguminous Cover Crops for Restoration of Degraded Lands - A Case Study in the Kwaebibirem District in the Eastern Region of Ghana

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ABSTRACT

Land degradation is the "the temporary or permanent lowering of the productive capacity of land as a result of human activities. In sub-Saharan Africa, land degradation is especially widespread affecting 20-50% of land and some 200 million people. Land degradation threatens global food security and environmental quality. Land degradation is a major problem in Africa where inappropriate farming methods, deforestation, overgrazing and mismanagement of land resources have rendered over 320 million hectares of land unsuitable for any meaningful agriculture. In the Kwabibirem district, the cause of land degradation include the activities if illegal diamond and gold prospectors that compromise or change the soil characteristics as a result of dumping of significant qualities of subsoil from underground to the surface. Inappropriate farming practices also lead to nutrient mining, use of bush fires as a method for land preparation that results in the burning away of the accumulated soil organic matter, and removal of crop residues from sites have rendered most lands infertile in the district. Experiments were conducted at the University of Ghana Agricultural Research Center- Kade to evaluate the use of two leguminous cover crops in improving the fertility of degraded soil using the following soil indicators; soil organic matter content, soil pH, soil N, P, K, content in the short (pot experiment) and in the long term on the performance of *Mucuna bracteata* (Mb), *Luffa eagyptiaca* (Luffa) and *Pueraria Phaseoloides* (Pp) grown under oil palm plantation of the Ghana Oil Palm Development Company (GOPDC), Okumaning over a six year period.

Also a survey was conducted to ascertain the extent to which farmers in the Kwabibirem district use leguminous cover crops for land restoration purposes.

The dry matter production within the 160 days (short term) was highest in Luffa, but no significant difference in dry matter yield was observed between Mb and Pp, although at 70 days the dry weight of Pp was higher than Mb. No significant changes in the soil chemical properties were observed due to leguminous cover in the short term. Luffa decreased the soil N, pH and organic matter content under both degraded and non degraded soil. Within 70 days in the pot experiment, nitrogen fixation was higher in Mb (1.73 gN/pot) than Pp (1.15 gN/pot) under the

degraded soil conditions. Under the long term conditions in the oil palm plantation, periodic measurements (4 times/year) of the biomass, soil moisture content, soil chemical properties were carried out along the toposequence (upslope and low land). Similarly, the effects of cover crop on the growth, vegetative parameters and yield were also assessed and compared with a non-legume covered area. Biomass production of Mb was higher than Pp, and the dry matter production was higher at the lower than at the upper slopes.

The total biomass of Mb was significantly higher than Pp at both lower and upper slopes; The total dry weight of Mb was 24% higher than Pp at the upslope, and 31.7% higher than Pp at the lower slope. The highest contribution to annual total dry weight was recorded in July, contributing between 42.26% and 45.7% of the total annual dry weight. The lowest contribution was observed in February and it ranged from 12.2% to 16.3%. Nitrogen accumulation was consistently higher in Mb, than Pp, accumulating 30% higher than N at the upslope, while at the lower slope Mb accumulated 50% higher N than Pp. Among the treatments, Mb conserved the highest soil moisture during the dry period 14.1%, 10.4% for Mb and Pp respectively for the upslope, and 25.5%, and 11.4% for Mb and Pp respectively, while non-leguminous cover recorded 8.7% at the lower slope. The soil pH increased from 4.9 at the upslope to 5.8 under Mb and 6.0 under Pp.

Similarly, at the lowland, soil pH increased from 4.60 to 5.33 under Mb and 5.73 under Pp, while non-leguminous area was 5.0. Furthermore, at the upper slopes, the soil OM increased from initial 4.35% to 4.62% under Mb but decreased 3.38% under Pp, while at the lower slopes OM increased from 2.78% to 4.87% under Mb and 3.65% under Pp and non-legume area was 2.14%

Similarly increases in soil N concentration from initial 0.14% at the upper slope to 0.45% under Mb, and 0.38% under Pp. At the lower slope, N concentration improved from initial 0.20% to 0.41% under Mb and 0.33% under Pp, while the non-legume crop area was at 0.21%. The soil available P increased from 2.32 mg/kg at the upper slope to 3.72 and 3.28 for Mb and Pp respectively. Similarly, at the lower slope, available P increased form initial 2.40mg/kg to 3.48mg/kg and 3.15mg/kg for Mb and Pp respectively and 2.15mg/kg for the non-legume cover area. The K concentration increased significantly from an initial 0.05% at the upper slope to 0.29% and 0.27%. The differences in the improvement of the soil fertility of the cover crops might be due to the reported deeper roots of the Mb compared to the Pp and non-legume cover crop, and higher biomass production.

Mucuna bracteata was better in increasing oil palm yield, recording 17 t/ha at the lower slope, as against 13 t/ha for Pp and 8 t/ha for the non-legume cover area. At the upper slope, yield increase was 10.8 t/ha for Mb against 7.3 t/ha for Pp through improved soil fertility status (higher soil pH, OM, N, P, and K), and soil moisture contents. The survey showed that about 70% of those interviewed know that the leguminous cover crop is good in suppressing weeds, improve soil moisture conditions, but it does not improve upon the nutrient content of the soil. Thus few people know about its use in restoring soil fertility. Hence, there is the need to disseminate the innovation for reclamation of such abandoned lands in the district using leguminous cover crops.

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