

Potential of perennial legumes for restoration and reutilization of small-scale gold mined sites in Ghana

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I. Introduction

- Small-scale gold mining, mostly illegal, has caused severe and extensive degradation of productive lands in Ghana (Anokye & Darko, 2025; Mensah et al., 2025).
- Activities are expected to surge due to increased pressure for precious minerals owing to the green energy transition and technological advancement (Laing & Pinto, 2023).
- Application of fertile topsoil and organic amendments, crucial for degraded mined land restoration is not feasible.
- Revegetation with fast growing perennial legumes may have the potential to overcome these major constraints.
- Therefore, potential of three common legumes in restoring soil organic carbon (SOC) and nitrogen (N) contents, and the productivity of surface gold-mined degraded soils under the influence of these legumes was evaluated.

II. Methodology

- A field experiment was set up on a degraded mined site at Anumso in the Bosome-Freho District in the Ashanti Region (Ghana).
- *Leucaena leucocephala* and *Pueraria phaseoloides* (using seeds) and *Gliricidia sepium* (using stem cuttings) plots were established.
- Treatments were monitored for five years to assess SOC and total N contents as soil fertility improvement indicators.
- Three years after revegetation, soil productivity was evaluated in *Pueraria*, *Gliricidia* and un-revegetated (control) plots using maize (*Zea mays*) as the test crop.



Fig. 1: Initial experimental site conditions and plant of perennial legumes

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III. Results

- Legume treatments substantially increased SOC and total N.
- SOC and total N increased by at least 78% and 115%, respectively, relative to the control treatment after 5 years.
- Evidence of soil cover and organic matter accumulation under legume treatments and possible biological N fixation which mediated these improvements.
- Legume treatments exerted substantial positive effect on the growth of maize 3 years after establishment compared to the control treatment.
- However, soil improvement observed in terms of SOC and N enrichment appears insufficient after 3 years of fallow to influence maize productivity.

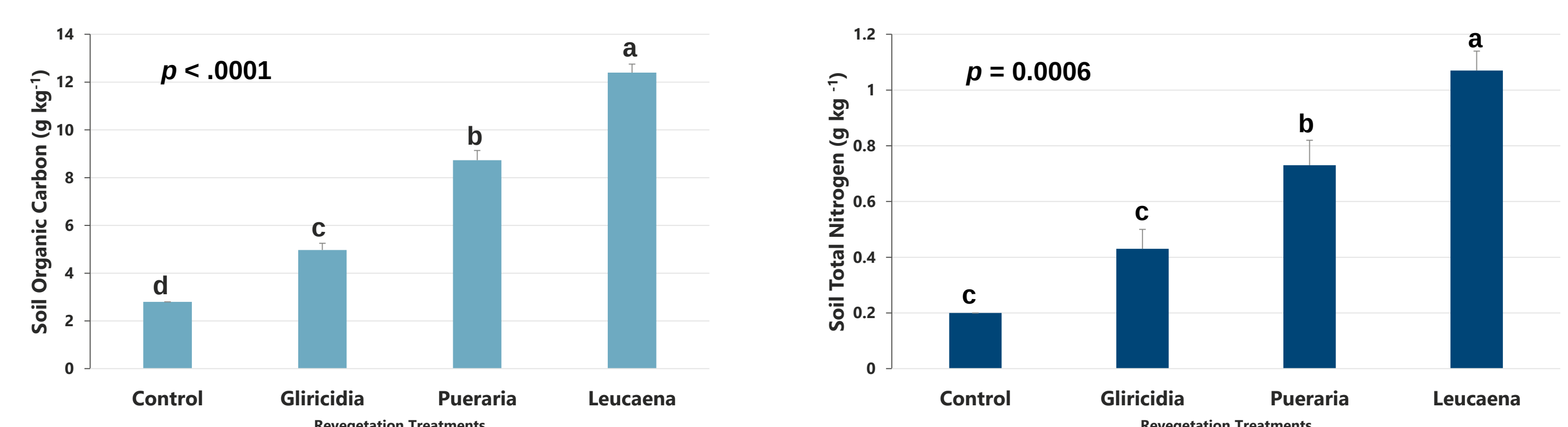


Fig. 2: Soil organic carbon and total nitrogen contents of revegetation treatments after 5 years, columns separated by different letters are significantly different.

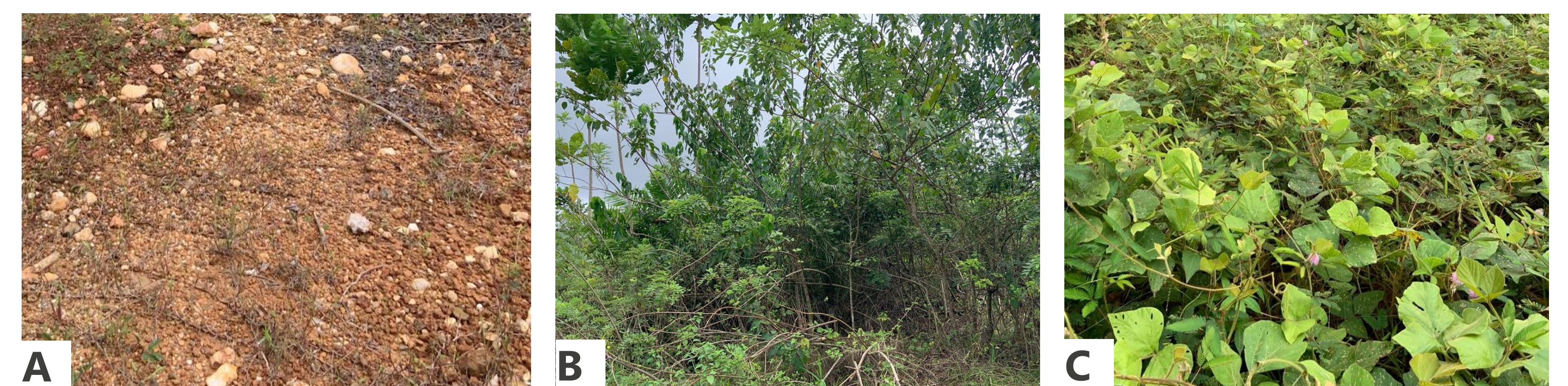


Fig. 3: Revegetation treatment plots after 5 years; A: control, B: *Gliricidia sepium*, C: *Pueraria phaseoloides*.



Fig. 4: Productivity evaluation using maize after 3 years; A: control plot, B: *Gliricidia sepium* plot, C: *Pueraria phaseoloides* plot.

IV. Conclusion

- Perennial legumes demonstrated high potential in increasing SOC and N in enhancing the fertility of degraded mined soil without fertile topsoil and organic amendments.
- Extended revegetation duration with complementary nutrient management may be crucial in harnessing the full potential of perennial legumes.
- Further studies on revegetation duration and other crops for productive reutilization are recommended.

References

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