

ACTION RESEARCH: Phytoremediation of mine waste contaminated soil in coal mining area of Jaintia Hills, Meghalaya using Palmarosa [*Cymbopogon martinii* (Roxb.) Wats.]

- Project Funding: MCLLMP.
- Project Period: 1 year.

Goal: Rehabilitation of coal mine spoilt degraded soil using phytoremediation method for sustainable livelihood and income generation for the local people residing in coal mining areas.

Aims and Objectives:

- To convert degraded land into cultivable land.
- To promote livelihood of rural marginal farmers by creating an environment that is supportive of the commercial cultivation of MAPs.
- Improvement of socio-economic status of the local inhabitants.

Project activities:

1. Site Identification.
2. Estimation of physico-chemical properties of the soil.
3. Cultivation and establishment of *Cymbopogon martinii* (Roxb) Wats, Palmarosa PRC-1 variety plantation through slips for subsequent harvest.
4. Estimation of vegetative parameters of *Cymbopogon martinii* (Roxb) Wats for specified time, and sample size.
5. Extraction of the essential oil from the shoots and estimation of oil yield, oil quality.
6. Determination of phytoremediation, phytostabilization and hyperaccumulator capacities of Palmarosa.
7. Post-harvest assessment of the soil.
8. Post-harvest utilization of biomass after hydro-distillation.

Expected Project Outcome: Coal mine degraded soil will be improved through the introduction of Palmarosa. This will result in bio reclamations of soil in mine spoilt area into cultivable landforms, socio-economic upliftment of rural area, employment generation and biodiversity conservation.

PHASE I: (i) Site identification (ii) Land Development

1. (i) Site identification

Site: **1. Narwan, Saipung block- East Jaintia Hills**

Latitude: 25° 22'59" N; Longitude: 92°23'32"E.

2. Tluh, Saipung block- East Jaintia Hills.

Latitude: 25° 20'49" N; Longitude: 92°27'17"E.

A. SUITABILITY EVALUATION:

(i). Climate

a. Average annual temperature*: Max 23.04° C; Min 14.6° C.

b. Average annual rainfall*: 1200-3000mm.

(* Source: District Statistical Handbook, East Jaintia Hills, 2008)

B. SITE(s) DESCRIPTION:

(i) Status of site: Non-Agricultural

(ii) Area: 0.80 Hectare (Ha.).

(ii) Vegetation: Short grassland; rainwater-fed.

C. SOIL DESCRIPTION:

C. (i): Qualitative observations:

(a) Rock Outcrops (Exposure of bedrock): 0% surface cover.

(b.) Coarse Surface fragments (Presence of gravel): 2% surface cover.

(c.) Erosion: Human induced.

(d.) Degree of erosion: Slight to Moderate {Evidence of damage of surface horizons and original biotic functions largely intact}.

(e.) Texture: Clay in a depth of 15cm and silt in a depth of 20 cm.

(f.) Soil Colour (Indication of composition and present oxidation- reduction of soil):Hue intensity: 1-(dark brown); Brown in a depth of 15 cm; orange in a depth of 20 cm- indicates the presence of iron oxides.

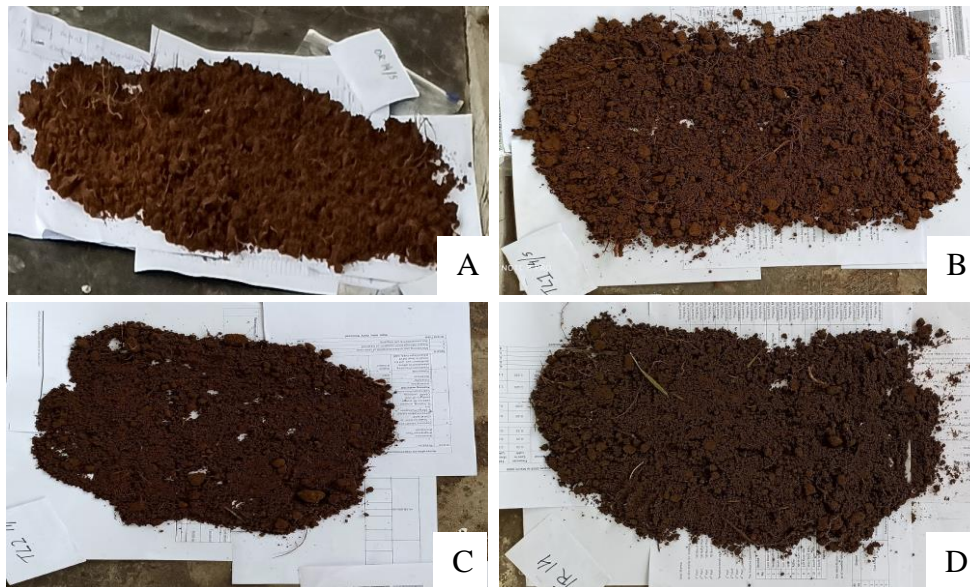


Figure: A&B: NR1 & NR2 soil samples collected from Narwan.
C&D: TL1 & TL2 soil samples collected from Tluh.

1. (ii): Land Development:

D. LAYOUT MAP OF THE PLANTATION SITE:



Figure.1: Layout map

The 0.80 Ha. site will be made into small plots of 10 meter(m) and each plot will be separated by a 1m wide gap for easy access like cleaning, weeding and maintenance of the plantation later after plantation. There will be a small footpath of 0.61m wide at the centre going through the field.

Due to poor water holding capacity of the soil, trenches will be dug along each of the plots. After discussion with our field engineer and surveying of the field, the trenches having a width of 0.30m and 0.61m in depth will be sufficient and the distance between two trenches down the slope can be from 50m-60m depending on the slope of the area. Rough illustration of layout is given in Figure.1

Manpower: 55 individuals are engaged for preparation of the plantation site from. 23 from Narwan and 22 from Tluh each from their respective IVCS.

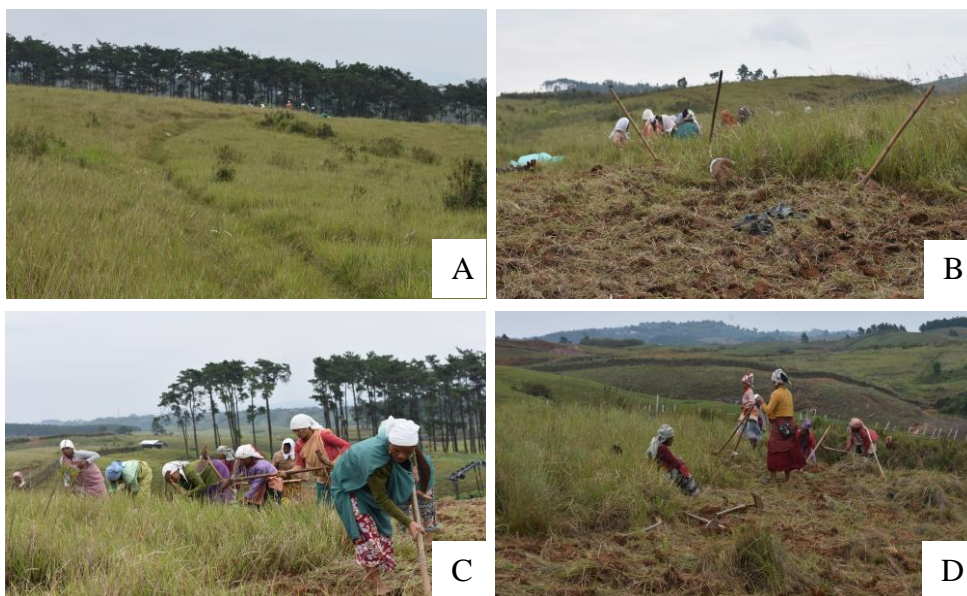


Fig.2. : A- Narwan site; B, C &D- Land development initiated from the 18/05/2020.

PHASE II:

9. Estimation of physico-chemical properties of the soil- Preliminary soil analysis before the introduction of the MAPs was recorded that the mean value of soil organic carbon SOC % is at 1.95 at Narwan and 2.33 in Tluh, this could be the interference of lateral roots of plants organic parts. More analysis has to be conducted for conclusive reports as suggested by ICAR, Umiam.
10. Cultivation and establishment of *Cymbopogon martinii* (Roxb) Wats, Palmarosa PRC-1 variety plantation through slips for subsequent harvest.
 - (i) Setting up of nursery(Narwan+Tluh): Raise Bed (1mx4m)



Fig 3. A.-Palmarosa nursery at Narwan. B- Palmarosa nursery at Tluh; C- Broadcast of seedsD- Palmarosa seedlings.

E: PROSPECTIVE

1. Estimation of vegetative parameters of *Cymbopogon martinii* (Roxb) Wats for specified time, and sample size.

PHASE III:

1. Extraction of the essential oil from the shoots and estimation of oil yield, oil quality.
2. Determination of phytoremediation, phytostabilization and hyperaccumulator capacities of Palmarosa.

PHASE IV:

1. Post-harvest assessment of the soil (Physico-chemical parameters)
2. Post-harvest utilization of biomass after hydro-distillation.
