INVESTIGATING THE ALLEVIATION EFFECT OF DIFFERENT VEGETATIVE GRASS SPECIES ROOT DEVELOPMENT ON COMPACTED SURFACE MINE SOILS

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Introduction

RESEARCH SITE:

Open cast Coal Mine, Mpumalanga Highveld. Established trial plots.

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Aims and Objectives

- Decompaction of surface mine soils through vegetative grass species root development

  - Biological compaction alleviation
  - Improve soil physical properties

More sustainable soil environment

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Methodology

MEASURE AND COMPARE THE FOLLOWING DATA:

- Planting Density & Basal cover
- Penetration resistance (per soil depth profile)
- Root dry mass
  - 0-100mm depth
  - 101-200mm depth
  - 201-300mm depth
- Carbon content (topsoil)

Generate a three-dimensional "model" for each treatment type's root penetration and decompaction ability

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Methodology

Plant density
and
Basal cover

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Methodology

Root dry mass determination

- Remove roots
- Sieve
- Weigh dry root mass

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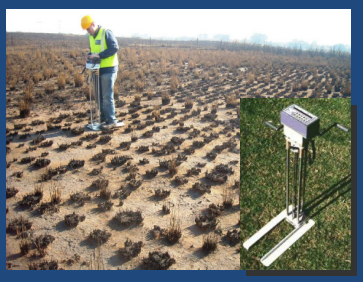
Methodology

Measuring soil Resistance

P5 hand-held Penetrometer and data collection software



Methodology

– Utilize 4 vegetative grasses with aggressive root systems:

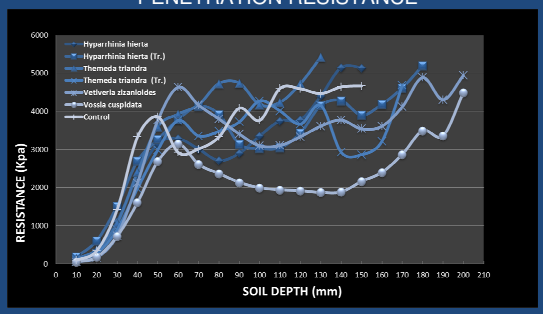
Without Fertilizer
Hyparrhenia hirta common thatching grass
Themeda triandra (red grass)
Vossia cuspidata (hippo grass)
Vetiveria zizanioides (*vetiver* grass)

With Fertilizer
Hyparrhenia hirta (common thatching grass)
Themeda triandra (red grass)

Control
Mixed Species without fertilizer

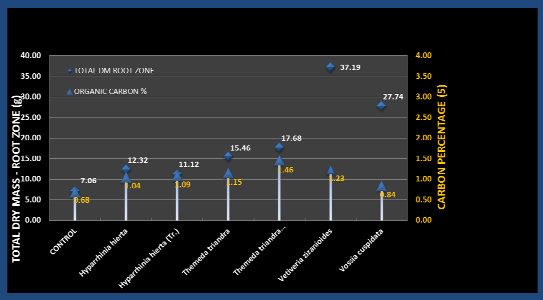
Results

PENETRATION RESISTANCE



Results

ROOT DRY MASS & CARBON CONTENT

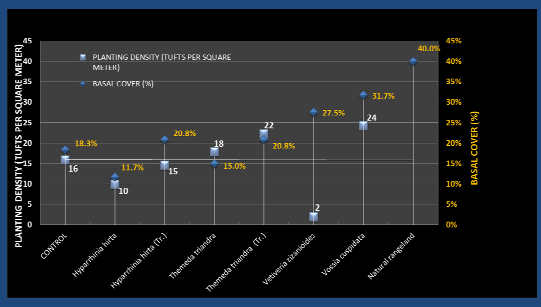


Discussion and Correlation Studies

1. Basal cover vs. Planting Density
2. Organic material yield per Ha found in soils
3. Carbon percentage and correlation results with basal cover
4. Long-term benefits of fertilizer treatment

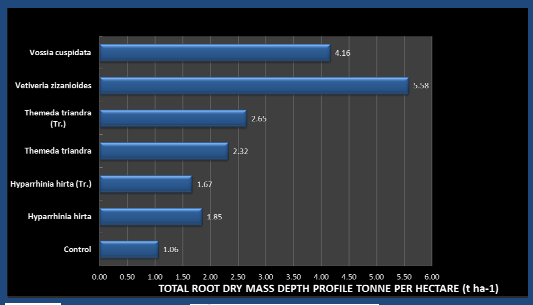
Interesting Correlation Results

1. BASAL COVER VS. PLANTING DENSITY



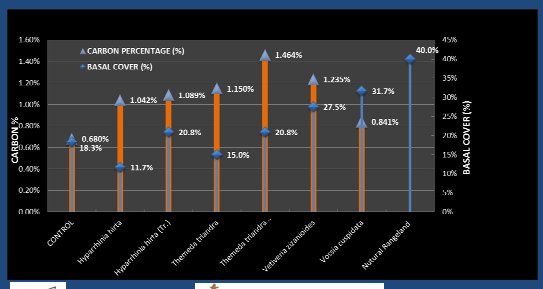
Interesting Correlation Results

2. ORGANIC MATERIAL YIELD PER HA



Interesting Correlation Results

3. CARBON PERCENTAGE AND CORRELATION RESULTS WITH BASAL COVER



Interesting Correlation Results

4. LONG-TERM BENEFITS OF FERTELIZER TREATMENT

	BASAL COVER (%)	DRY ROOT MASS TAKEN FROM 0-100mm SOIL DEPTH (g)	DRY ROOT MASS TAKEN FROM 101-200mm SOIL DEPTH (g)	DRY ROOT MASS TAKEN FROM 201-300mm SOIL DEPTH (g)	TUFT DIAMETER DIAM. (mm)
Control - no treatment	18.3%	6.203	0.583	0.277	117.78
H. hirta - with no treatment	11.7%	11.303	0.663	0.357	123.33
H. hirta - with treatment	20.8%	9.877	0.9	0.347	107.78
T. triandra - with no treatment	15.0%	14.05	1.053	0.353	105.55
T. triandra - with treatment	20.8%	14.05	2.48	0.247	86.11

Summary – highlights

1. *V. zizanioides* compaction was largely overcome successfully
   (V. zizanioides and *V. cuspidata* comparatively did indicate a much wider zone of influence, especially at the crucial topsoil depth of 100-150 mm and beyond.)
2. Results indicate *V. zizanioides* superior ability to overcome compaction beyond 150 mm
3. The results obtained for *V. cuspidata* are similarly impressive
4. Comparing treated grass species that received fertilizer application during the establishment period may have marginally impacted the overall resistance factors as indicated with *H. hirta* and *T. triandra*.

Conclusion

The correct selection of species with a known root structure and basic management requirement has the potential to be useful in creating an organically rich, alleviated and more sustainable soil environment to ensure improved rehabilitation results of surface coal mines.

Terms and (unique site) conditions apply

Thank You

SPECIAL THANKS TO:
Centre of Environmental Studies (UP)
Department of Plant Production and Soil Science (UP)
GSSA

Discussion

- QUESTIONS?
- COMMENTS?