

# NORTH WEST DEPARTMENT OF AGRICULTURE AND RURAL DEVELOPMENT

Soil Physical Characteristics: Potchefstroom College of Agriculture  
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Agriculture &  
**Rural Development**  
Department:  
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REPUBLIC OF SOUTH AFRICA



# Soil physical characteristics

## **Introduction**

Soil physical characteristics are the field parameters that define movement of air and water/dissolved chemicals through soil, as well as conditions affecting germination, root growth, erosion processes and mainly to determine soil health status.

From: [Advances in Agronomy, 2018](#)

# Soil profile description purpose

1. To Identify soil suitability for crop production
    - Identifying soil for cultivated/natural pastures
    - Delineating marginal and outcropped areas
  2. Identifying ecological sensitive areas
  3. Development of soil potential, utilization value and mapping
- Sustainable soil management (Hardly, 2009)

# Materials used for profile description

## 1. Soil Profile pit



## 2. Geological hammer



## 3. Tape measure



# Materials used for profile description

## 4. Classification book



## 5. Water bobbles

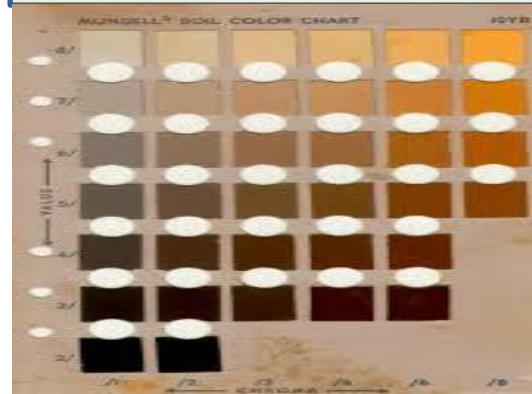


## 6. 10% Hydrochloric



# Materials used for profile description

## 7. Mussel Soil Colour chart



## 8. Global Position system



## 9. Pen and a paper

# 8-Soil physical characteristics to be determined

1. Soil texture
2. Soil structure
3. Soil Consistency
4. Soil Colour
5. Soil mottles
6. Soil absorption rate
7. Effective depth
8. Plus soil bulk density

# Soil Physical Characteristics

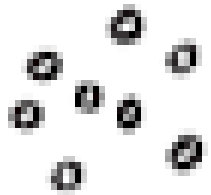
## 1. Soil texture – the relative proportion of sand, silt and clay

Texture	Class	Remarks
0 – 10%	Sand	No dirty hands
10 – 15%	Loam Sand	Dirty hands, visible skin
15 – 20%	Sandy Loam	Dirty hands, no visible skin
20 – 35%	Sandy Clay-loam	Forms a sausage roll
35 – 55%	Sandy Clay	Forms a sausage roll with no cracks
55% plus	Clay	Forms a full circle without cracks



# Soil Physical Characteristics

## 2. Soil Structure – the extent in which soil particles combine together to form structural units (aggregates or peds)



SINGLE GRAIN



GRANULAR (porous)



MASSIVE



CRUMB (very porous)



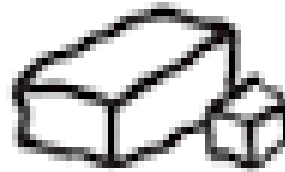
PLATY or LAMINAR



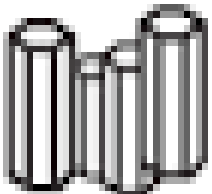
FRAGMENTAL



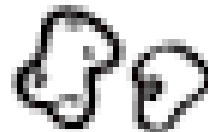
PRISMATIC



BLOCKY



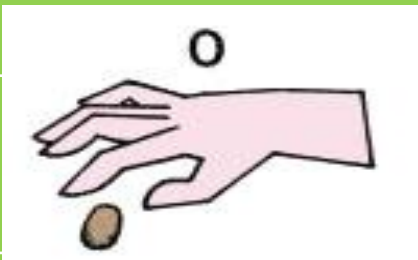
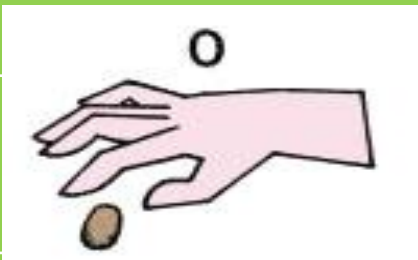




COLUMNAR



NUT-LIKE

# Soil Physical Characteristics

## 3. Soil Consistency – physical behaviour of soil at different moisture levels under mechanical pressure

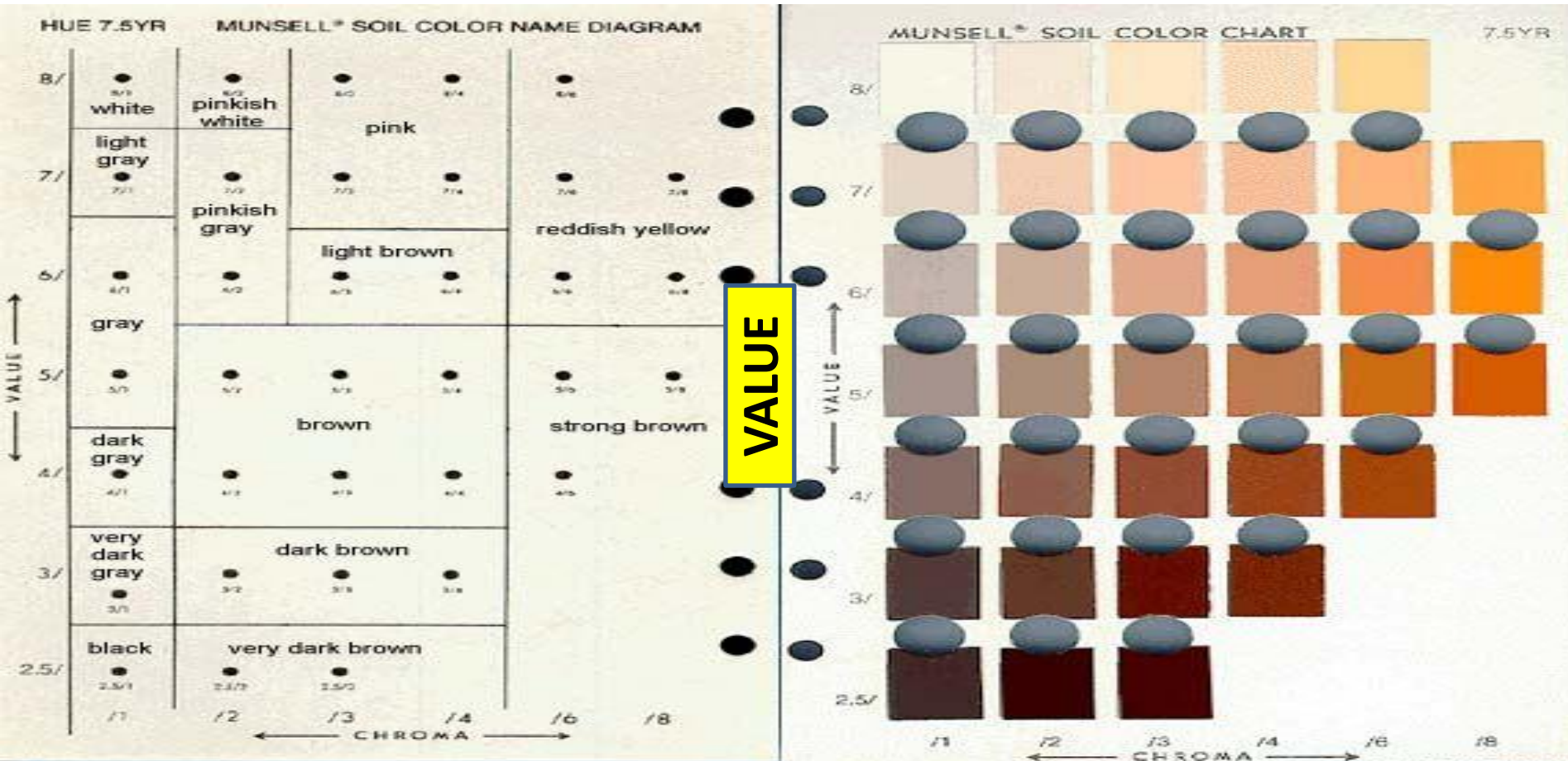
DRY SOIL CLASS	DRY SOIL DESCRIPTION	MOIST SOIL CLASS	MOIST SOIL DESCRIPTION
Loose	Non-coherent	Non - sticky	
Soft	It crushes under very low pressure	Non - sticky	
Slightly Hard	It crushes under low pressure	Slightly sticky	
Moderately Hard	It crushes under moderate pressure	Sticky	
Hard	It crushes under strong pressure	Sticky	
Extremely Hard	Pressure applied by foot under full body weight	Very Sticky	

# Soil Physical Characteristics

4. Soil colour – (Mineralization & chemical changes) - indicates both the fertility and moisture regime of the soil

Example - 7.5YR5/4

HUE



CHROMA

# Soil Physical Characteristics

5. Soil mottles – refers to secondary soil colours, not compositional properties and it is associated with periodic wetting



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- Are the matrix of colours
- Mottles indicate fluctuating water table
- Soil matrix with grey/gley colour is called Soft Plinthic/hard plinthic

# Soil Physical Characteristics

**6. Water Absorption – the rate at which water penetrate through the soil profile at field capacity**

Absorption Rate/second	Reaction
1 sec	Too quick
1 – 5 sec	Quick
5 – 15 sec	Moderate
15 -45 sec	Slow
45-60 sec	Very slow

# Soil Physical Characteristics

7. Effective depth – the depth at which a plant will be able to exploit adequate nutrients & water and gaseous exchange in a soil profile (for summer grain crops)

## Profile 1

STERKSPRUIT FORM – 9a



**Orthic A**  
0 – 300mm

**B-Horizon**  
300-600  
Mm

## Profile 2



**Orthic A**  
0 – 300mm

**B-Horizon**  
300-  
1500mm

# 7. SOIL PROFILE DESCRIPTION FORM

**PROFILE NO:**

**COORDINATES**

## **Diagnostic Topsoil Horizon**

Texture - %Clay

Structure

Soil Colour

Depth

## **Diagnostic Subsoil Horizon**

Texture - %Clay

Structure

Soil Colour

Depth

Restrictive Layer

Effective depth

Soil form

Soil family

# 13. Steps to follow for soil profile diagnosis

1. Choose a sunny side
2. Remove at least 3cm of soil from profile face
3. Mark master horizons: A, B, C, E, G, R (P.8-Blue book)
4. Take representative samples of each horizon and place it outside
5. Identify diagnostic horizon; noting all soil physical characteristics
  - Top soil – P.15, blue book
  - Sub soil – P.17, blue book
  - Soil form key – P.44, blue book
6. Measure depth of each horizon
7. Identify restrictive layer
8. Measure horizon's depth, effective depth and get out of the profile
9. Determine texture and colour of the taken representative samples
10. Identify soil form and family
11. Give a name to the soil family – P49, blue book



# Conclusive Remarks :

- Soil physical characteristics advocate the needs for :
- ✓ Sustainable soil management
- ✓ Mitigate against Climate change and shrinking land size
- ✓ Feeding the World population of nine billion by 2050 (FAO)
- ✓ Advocacy for Common stewardship by different stakeholders
  - Environmentalists
  - Conservationists
  - Agricultural Scientists
  - Policy makers

THE NORTH WEST DEPARTMENT OF  
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“A nation that destroy its soils  
destroys itself”

Franklin D. Roosevelt

*Re a leboga*



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