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ASAC 1101 : FUNDAMENTALS OF SOIL SCIENCE (2+1)

Level : B.Sc (Ag), I semester

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**SOIL SCIENCE AND AGRICULTURAL CHEMISTRY
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Topic

Soil Permeability and Soil Color

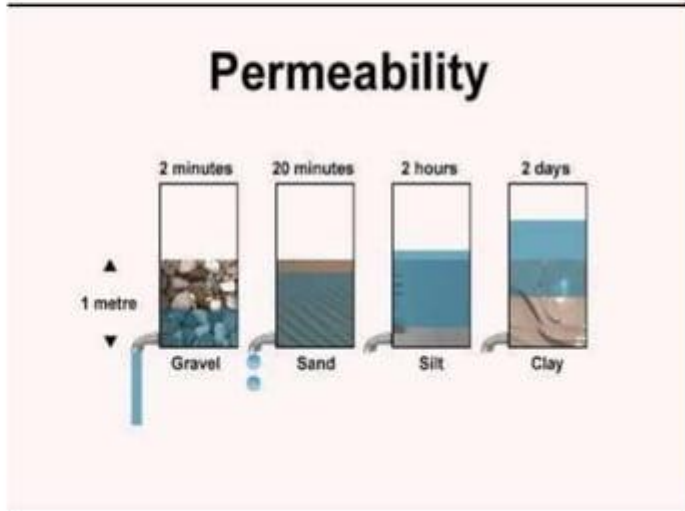
Soil Permeability and Soil Color

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Permeability of Soil

- The characteristics of soil that determine the movement of water through pore space



Factors affecting Permeability of Soil

Size of Soil Particle - If the soil is coarse-grained, permeability is more and if it is fine-grained, permeability is low.

Specific Surface Area of Soil Particle - Higher the specific surface area lower will be the permeability.

The shape of Soil Particle - Rounded Particles will have more permeability than angular shaped. It is due to the specific surface area of angular particles is more compared to rounded particles



Void Ratio - In general, Permeability increases with void ratio. But it is not applicable to all types of soils. For example, Clay has high void ratio than any other type of soil but permeability for clays is very low. This is due to, the flow path through voids in the case of clays being extremely small such that water cannot permit through this path easily.



Soil Structure - If soil contains a flocculated structure, the particles are in random orientation and permeability is more in this case. If the soil contains a dispersed structure, the particles are in face-to-face orientation hence, permeability is very low.

Degree of Saturation - Partially saturated soil contain air voids that are formed due to entrapped air or gas released from the percolating fluid or water. This air will block the flow path thereby reducing the permeability. **Fully saturated soil is more permeable than partially saturated soil.**



Temperature - Greater the temperature, the higher will be the permeability. That is the reason, seepage is more in summer seasons than in winter

Adsorbed Water - Adsorbed water is the water layer formed around the soil particle, especially in the case of fine-grained soils. This reduces the size of the void space by about 10%. Hence, permeability reduces.

Organic Matter – The presence of organic matter decreases permeability. This is due to the blockage of voids by the organic matter.



Variation in Soil Permeability due to Soil Texture

Soil	Texture	Permeability
Clayey soils	Fine	From very slow to very rapid
Loamy soils	Moderately fine	
	Moderately coarse	
	Coarse	
Sandy soils	Fine	



Variation in Soil Permeability due to Soil Structure

Structure type		Permeability
Platy	Greatly Overlapping	From very slow to very rapid
	Slightly Overlapping	
Blocky		
Prismatic		
Granular		



Soil Color

- Soil Color tells us stories about how the soil formed.
- Color development and distribution of color within a soil profile are part of weathering.
- Iron forms small crystals with a yellow or red color, organic matter decomposes into black humus, and manganese forms black mineral deposits.
- Color is also affected by the environment. With depth below the soil surface, colors usually become lighter, yellower, or redder.



Types of Soil Color

- **Lithochromic** = Soil color inherited from parental materials. Soils that are the same color throughout the profile as the underlying parent rocks are generally called lithochromic soils. These soils are commonly red, gray, or black.

- **Acquired or genetic color** = due to soil forming process






Factor imparting Soil Color

Clear or White Soil Color

They may be white from which they may be **influenced by calcium and magnesium carbonates, gypsum or other more soluble salts**. Presence of crystals or silica also influence.

Brown Soil Color

Brown soils might be brown from **decaying plant material**. **The darker color often indicates an increase in decomposed organic matter known as humus**. Soil has living organisms and dead organic matter, which decomposes into black humus. Humus color decreases with depth and iron pigments become more apparent.



Yellow or Red Soil Color

Yellow or red soil indicates the presence of oxidized ferric iron oxides. The red color might be mainly due to ferric oxides occurring as thin coatings on the soil particles while the iron oxide occurs as **hematite** or as **hydrous ferric oxide**, the color is red and when it occurs in the **hydrate form as limonite** the soil gets a yellow color.

Grey Soil Color

Organic matter plays an indirect, but crucial role in the removal of iron and manganese pigments in wet soils. All bacteria, including those that reduce iron and manganese, must have a food source. Therefore, anaerobic bacteria thrive in concentrations of organic matter, particularly in dead roots. Here, concentrations of gray mottles develop.



Factor affecting soil color

- Easily identified property.
- Used to relate chemical/physical properties such as watertable depth, drainage, chemical constituents, formation, horizons.



Aspects of soil color

- Hue
- Value
- Chroma

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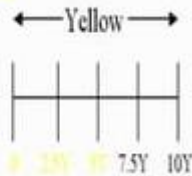
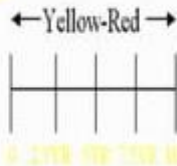
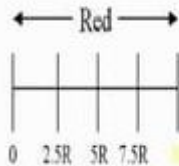


- The munsell color book is used to document color in a standard notation.
- **Hue:** Dominant spectral color.
- **Value:** The degree of light/dark of a color in relation to a neutral gray scale.
- **Chroma:** Strength of hue.



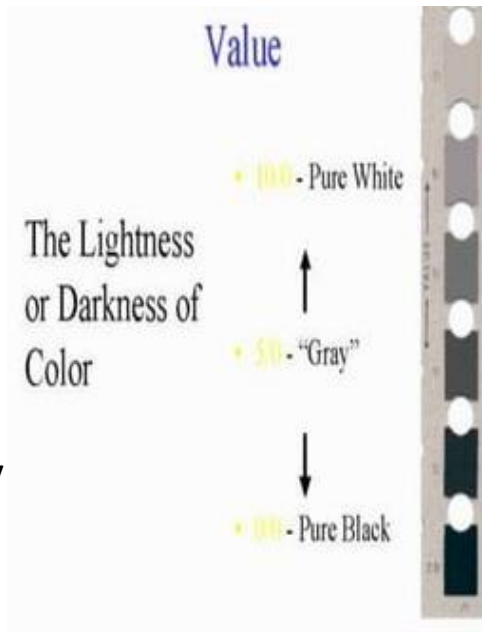
Hue

- It is the dominant spectral color.
- It is arranged radially from one arid to next card.
- The symbol is the letter of abbreviation of rainbow (VIBGYOR) proceeded by numbers from 0 to 10.



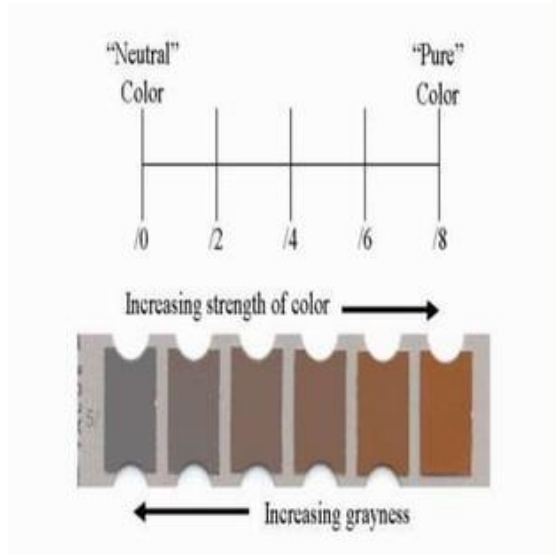
Value

- It is the measure of intensity of light.
- The notation consists of numbers from 0 to 10, where 0 is for absolute black and 10 is for absolute white.
- It is vertically arranged.
- The color becomes successively lighter from bottom to top of the card and value increases.



Chroma

- It is the relative purity of the light.
- Its notation consists of numbers beginning at '0' for grey and increases with decrease in grayness.



Reading Soil Colors

- Optimum conditions
 - Natural light
 - Clear, sunny day
 - Midday
 - Light at right angles
 - Soil moist
 - NO sunglasses!





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Coloring of Soil

Material	Chemical Composition	Color
Manganese	MnO ₂	Purplish Black
Hematite	Fe ₂ O ₃	Red
Goethite	FeOOH	Yellow
Hydrated Ferric Oxide	Fe(OH) ₃ ·nH ₂ O	Red Brown
Calcite	CaCO ₃	Whitish
Glaucanite	KMg(Fe,Al)(SiO ₃) ₆ ·3H ₂ O	Greenish



THANK YOU

