

Lecture Notes

Design of Subsurface Drainage Systems

1. Introduction

Subsurface drainage systems are engineered solutions designed to remove excess water from the soil profile, particularly from the root zone, to improve agricultural productivity and soil health. These systems are crucial in areas with high water tables or poor natural drainage.

2. Objectives of Subsurface Drainage

- Water Table Control
- Soil Salinity Management
- Improved Soil Aeration
- Enhanced Field Trafficability

3. Components of a Subsurface Drainage System

- Laterals
- Collectors/Main Drains
- Outlet Structures
- Envelope Materials

4. Design Considerations

- a. Drain Depth and Spacing
- b. Drainage Coefficient
- c. Soil Properties

d. Topography

5. Drain Spacing Calculations

Hooghoudt Equation:

$$S = \sqrt{8K(D - d)(H) / q}$$

Where:

S = Drain spacing (m)

K = Hydraulic conductivity (m/day)

D = Depth to impermeable layer (m)

d = Depth of the drain (m)

H = Height of the water table above the drain (m)

q = Drainage coefficient (m/day)

6. Layout Patterns

- Random
- Parallel
- Herringbone
- Gridiron

7. Installation and Maintenance

- Installation: Precise trenching and placement.
- Maintenance: Inspection for blockages and sediment accumulation.

References

- NPTEL Lecture Notes on Subsurface Drainage Design.
- IIT Bombay, Eldho, T.I., Drainage System Design Notes.
- Illinois Drainage Guide, USDA-NRCS.