



Centurion
UNIVERSITY

*Shaping Lives...
Empowering Communities...*

Drainage Engineering (BTAI3103)

Module 1 Basics of Agricultural Drainage (Lecture-01: Introduction to land drainage)

**DEPARTMENT OF AGRICULTURAL ENGINEERING, SoABE
CENTURION UNIVERSITY OF TECHNOLOGY AND MANAGEMENT
PARALAKHEMUNDI, ODISHA**



Centurion
UNIVERSITY

Shaping Lives...
Empowering Communities...

What is Drainage?

Drainage refers to the removal of excess things causing harmful effects.

- In case of **agricultural drainage**, it is the removal or disposal of excess water from agricultural land.
- Formation of **excess water** in agricultural lands may be due to **precipitation**, incoming of water from **overland flow** or **seepage flow** from the nearby areas, deposition of **flood water**, **over irrigation** of crop etc.



Centurion
UNIVERSITY

Shaping Lives...
Empowering Communities...

Why drainage is required?

- ✓ It is one of the **important requisites** for **successful cultivation** of agricultural crops, because presence of **excess water** in the root zone develops several bad effects on **soil-plant environment**.



Centurion
UNIVERSITY

*Shaping Lives...
Empowering Communities...*

Source of drainage problem

- ✓ Excess rainfall and irrigation
- ✓ Accumulation of seepage water from the reservoir, ditches and canal etc.
- ✓ Accumulation of seepage water in the valley due to excess water in high land.
- ✓ Inundation of low lying area from flood water.
- ✓ Stagnation of water in the field due to pockets and ridges and low drainage slope.
- ✓ Temporary stagnation of water due to poor disposal system.



Centurion
UNIVERSITY
*Shaping Lives...
Empowering Communities...*

What is Waterlogging?

- ✓ According to **FAO (FAO, 1973)**, waterlogged areas are those where soils are temporarily saturated or where the water table is too shallow such that capillary rise of groundwater encroaches upon the root zone and may even reach the soil surface.
- ✓ According to **National Commission on Agriculture (NCA)**, when water table causes saturation of crop root zone resulting in (Restriction to air circulation, Decline in Oxygen level, Increase in CO₂ level).



Centurion
UNIVERSITY

*Shaping Lives...
Empowering Communities...*

Classification of Waterlogging

Ministry of Water Resources, Government of India
(MOWR, 1991)

- ✓ Water logged area ($GWT < 2$ m)
- ✓ Potential Area for Waterlogging ($GWT = 2$ to 3 m)
- ✓ Safe Area ($GWT > 3$ m)

Different categories of waterlogged areas in India
(Bhattacharya and Michael, 2003)

Waterlogged Area: Water table is within 2 m from soil surface during pre-monsoon (April/May) or water table is within 1 m from soil surface during post-monsoon (October/November).



Centurion
UNIVERSITY
*Shaping Lives...
Empowering Communities...*

Classification of Waterlogging

Critical Area for Waterlogging: When the water table is between 2 and 3 m from the soil surface during pre-monsoon and/or between 1 and 2 m during post-monsoon, it is considered as critical.

Potential Area for Waterlogging: In monsoon Asia, irrigated areas with water table between 3 and 5 m during pre-monsoon may be considered as potential areas for waterlogging.



Centurion
UNIVERSITY

*Shaping Lives...
Empowering Communities...*

Bad effect of drainage problem

- Water filled in soil leads to poor aeration.
- Water filled soil not only remove the air but also the removal of harmful gases given off by the plants roots (ethane, methane, CO_2).
- Submerged condition reduces the root development and root decay. It leads to yellowing, reddening, scorched their stipple leaves.
- It leads to poor uptake of nutrients, destroyed the soil structure and reduce the micro-biological activity.
- It reduces the temperature, decreases the yield to significant extent or some time total damage of crop.
- Drainage problem causes unhygienic situation for human health.



Centurion
UNIVERSITY
*Shaping Lives...
Empowering Communities*

Causes of Waterlogging



Natural

- ✓ Heavy Rainfall
- ✓ Unfavourable Topography
- ✓ Backwater entry from River
- ✓ Rise of groundwater table to crop root-zone
- ✓ Seepage from canals and adjoining areas



Man-made

- ✓ Unscientific use of land and Water (excess irrigation)
- ✓ Faulty cropping pattern
- ✓ Blockage of natural outlet



Centurion
UNIVERSITY
*Shaping Lives...
Empowering C*

Causes of Excess Salt



Natural

- ✓ Soluble salts in parent rocks
- ✓ Sea water intrusion
- ✓ High evaporation during post monsoon period
- ✓ Backwater flow from river estuary



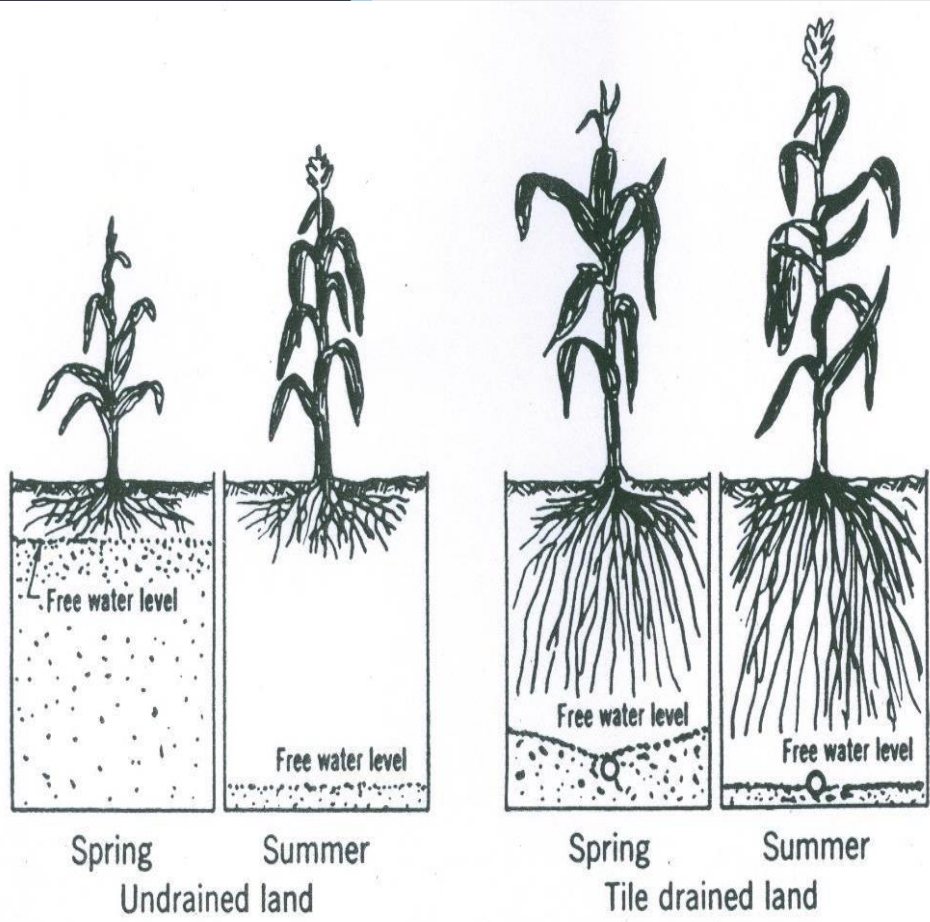
Man-made

- ✓ Irrigation Mismanagement
- ✓ Poor Land Leveling
- ✓ Leaving land fallow during dry periods especially in regions of shallow water table.
- ✓ Improper use of heavy machinery resulting in soil compaction
- ✓ Leaching without adequate drainage

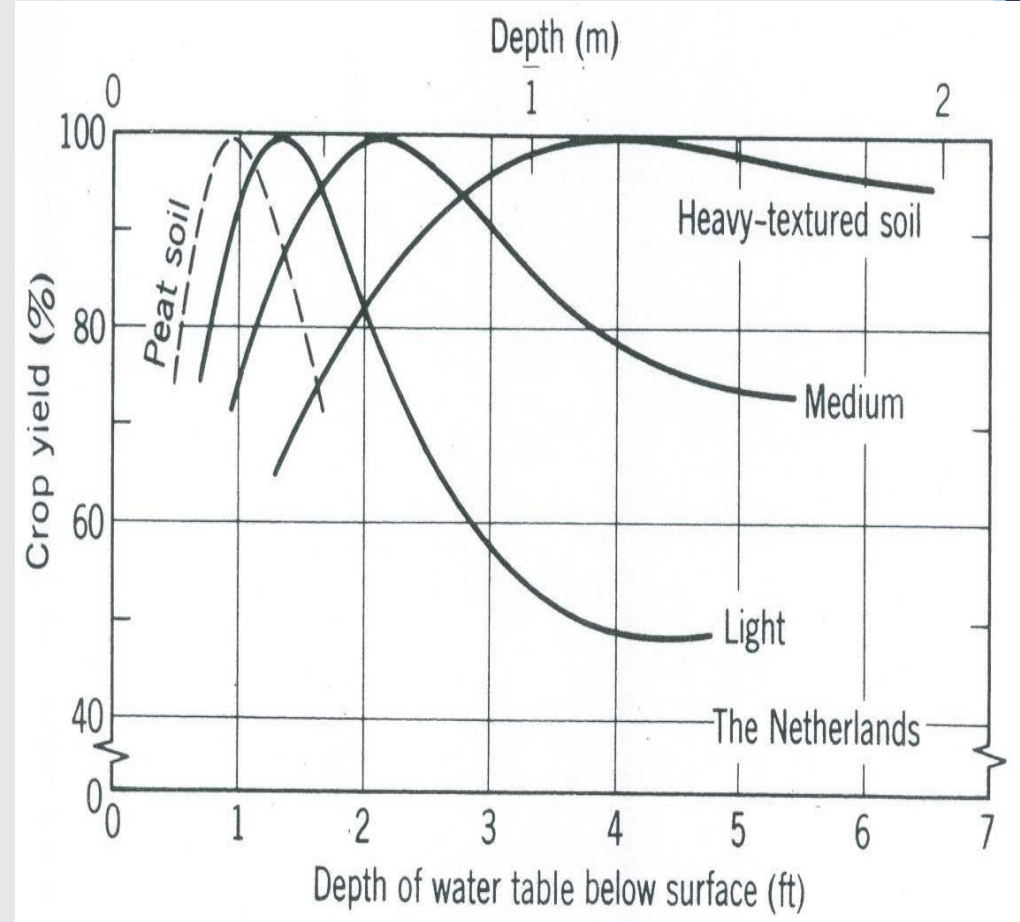


Centurion

Impacts of Waterlogging



Root development of crops grown on drained and undrained land



Relation between crop yield and constant water table depth during growing season



Centurion
UNIVERSITY

*Shaping Lives...
Empowering Communities...*

❖ Geographical, waterlogged and salt affected areas of some states in India (Bhattacharya and Michael, 2003)

Sl. No.	State	Geographical Area (Mha)	Waterlogged Area (Mha)	Salt Affected Area (Mha)
1	Andhra Pradesh	27.44	0.339	0.813
2	Bihar	17.40	0.363	0.400
3	Gujarat	19.60	0.484	0.455
4	Haryana	4.22	0.275	0.455
5	Karnataka	19.20	0.036	0.404
6	Kerala	3.89	0.012	0.026
7	Madhya Pradesh	44.20	0.057	0.242
8	Maharashtra	30.75	0.111	0.535
9	Orissa	15.54	0.196	0.400
10	Punjab	5.04	0.199	0.520
11	Rajasthan	28.79	0.348	1.122
12	Tamil Nadu	12.96	0.128	0.340
13	Uttar Pradesh & Uttaranchal	29.40	1.980	1.295



Centurion
UNIVERSITY

*Shaping Lives...
Empowering Communities...*

