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Impacts of Higher water Table on Growth of Crop Plants- A Botanical Analysis

Dr. Ved Parkash

Department of Botany, Govt. College of Education, Bhiwani (HR)

ABSTRACT

The water table **refers to the upper surface of the saturated zone in the ground, where all the spaces between soil particles or rock pores are filled with water and are fully saturated with water. It marks the boundary between the unsaturated zone where air fills the soil pore spaces and the saturated zone where water fills the soil pore spaces. In between these two zones there is a zone where air and water both exist in the pores. Many factors affect the water table like precipitation,** Topography, human activities, climatic conditions and type of vegetation growing. **The water table is highly dynamic and fluctuates over time due to seasonal variations, climatic conditions, and human intervention. Water table can very deep of very high. A** higher water table **refers to the level below the ground surface where the soil or rock is fully saturated with water.**
In this paper it is discussed about the causes oh higher water table, Impacts of water table on plants growth and development and the crops suitable for such soils.

Keywords: water logging, water table, Topography, water saturation.

INTRODUCTION

The water table refers to the upper surface of the saturated zone in the ground, where all the spaces between soil particles or rock pores are filled with water and are fully saturated with water. It marks the boundary between the unsaturated zone where air fills the soil pore spaces and the saturated zone where water fills the soil pore spaces. In between these two zones there is a zone where air and water both exist in the pores. Water table varies in depth depending on the location, the season, and environmental conditions. In areas with high rainfall or where the soil possess little porosity, the water table is often closer to the surface, while in arid regions, it may be very deep.

Many factors affect the water table like precipitation, Topography, human activities, climatic conditions and type of vegetation growing. The water table is highly dynamic and fluctuates over time due to seasonal variations, climatic conditions, and human intervention. Water table can very deep of very high. A higher water table refers to the level below the groundsurface where the soil or rock is fully saturated with water. This level rises or falls depending on factors like precipitation, evaporation, groundwater recharge, and usage. When the water table is high, it means that there is a large amount of water stored in the ground near the surface. High water table may be favourable for one crop and unfavourable for other crop.

CAUSES OF INCREASE IN WATER TABLE:

In some areas even in arid zones like villages of Charkhi Dadri in southern Haryana is very high though, the water is highly saline. Many factors are responsible for high water table in such areas like Increased rainfall can lead to a rise in the water table as the ground absorbs more water, Flooding or other events that introduce large amounts of water to the soil and reduced groundwater extraction like In southern Haryana, as water being saline is very less pumped out for irrigation.

GENERAL IMPACTS OF HIGH WATER TABLE

1. Surface flooding: Higher water tables can cause water to rise to the surface, swampy areas, or even flooding in low-lying regions. It is observed that water start coming out from the earth in rainy season from the regions where the water table is very high. It results in floods.

2. Effects on urbanization: A high water table can cause problems for foundations of buildings, roads, and other high structures. Such are are last choice for construction of buildings.

3. Effects on Agriculture: High water table leads to poor drainage, water logging in soils, and reduced crop yields. This is perhaps due to poor soil aeration. However, some crops like rice, it might support crops to flourish well and give more yield.

4. Deposition of salts on the soil surface: It is observed that areas where water table is very, a large quantity of salts get accumulated. This is due to high evaporation. The salt laden waters when evaporated, the salts get accumulated on the soil surface. It renders the soil unfit for seed germination and growth.

IMPACTS OF HIGH WATER TABLE ON CROPS

A high water table can have several impacts on crop productivity, which vary depending on the depth of the water table, the type of crops grown, and local environmental conditions. Crop patterns are changed over the time due to high water table.

1. Water-logging of Soil:
High water table is responsible for water logging. The soil spaces get fully saturated with water and fails to percolate in the water table. It posses many effects on crops growth and productivity. Some of the effects are:

Impact on Root breathing: When the water table rises too close to the soil surface, it leads to water-logging, where excess water fills the soil pores as a result the air gets replaced with water. This restricts oxygen supply to plant roots, impairing their ability to respire and absorb nutrients. In the absence of air roots fail to breath. ATP production is hindered and active transport of minerals failed.

Root Damage: In waterlogged conditions, with high water table roots gets suffocated, resulting in poor root growth and leading to root damage in many crops especially in sensitive crops like rice, corn, and cotton.

2. Effects on Nutrients in the Soils
Nutrient Loss: A high water table may cause nutrients loss, especially nitrogen, phosphorus, and potassium and leach out from the root zone.This reduces the availability of essential nutrients from the soils.As a result the crops suffers from nutrient deficiencies for the crops.
Fertilizer Use: When water is in excess in the soil, fertilizers are easily washed away from the root zone, making it difficult for the crop plant to survive and thus lowering crop yields.

3. Increase in Soil Salinity:
In the areas where the water table is high and contains dissolved salts, the rise in water level can bring salts closer to the surface, especially in arid or semi-arid regions. This can lead to soil salinization, which hinders plant growth by causing osmotic imbalances, reducing water and mineral uptake and damaging plant tissues. Long time high water table and deposition of salts on the soil surface can lead to long-term soil damage making it less productive for agriculture. A large area of land is now unproductive in Haryana due to water logging.

4. Sensitive to Diseases and Pests:
When the soils are water logged due high water table create an environment for growth of harmful fungi and bacteria. Many fungi like *Pythium* and *Phytophthora cause crop disease. High moisture content in the soil also attract pests which* attack on the plant roots.

5. Effects on Soil Structure:
Soil structure is important for the growth of crop plants for all the steps starting from seed germination, vegetative growth, flowering etc. Continuous saturation of the soil due to a high water table can lead to soil compaction, making it hard enough for roots to penetrate the soil. This compaction can also reduce the permeability of the soil, affecting drainage and aeration. It further prevent water percolation. High water tables can weaken the structural integrity of the soil particles. This decreases vegetation cover on the soil leading to easy soil erosion. Soil erosion is very fast especially heavy rainfall..

6. Impacts on Crop Variety and Patterns:
All crops are not equally tolerant to water stress. High water content may lead to crop damage. Certain crops like maize, Gram, Mustard and wheat are highly sensitive to waterlogged conditions and survive very hard. On the other hand, certain crops like rice are water-loving crops and flourish-well in a high water table areas. Crop patterns change is observed in

district Ch. Dadri of Haryana over the time due availability of canal waters which has raised the water table. The area was known for growth of gram crop which is now almost replaced with rice cultivation.

7. Effects on Plant Physiology:
Many functions starting from seed germination to crop maturation are directly affected by water logging due to high water table. Seed germination is the first event in plant growth which is adversely affected. Seeds may have difficulty in germination and establishing in soils where the water table is high. Seedlings fail to establish in such soils. Excess water can stress plants during key growth stages such as flowering and fruiting, reducing the quality and quantity of the harvest.

CROPS SUITABLE FOR HIGHER WATER TABLE

All crops are not suitable for high water table areas. Some crops grow well in water logged areas because they have developed specific adaptations that allow them to grow in water logged and oxygen-deprived soils. These adaptations enable them to cope with the challenges posed by waterlogged soils, such as low oxygen levels, high moisture content. These are able to tolerate oxygen deficiency created by water condition. Some features are evolved during course of evolution which allow the roots of these plants to uptake the minerals and maintain the water and ionic balance. These plants possess air filled spaces to survive in water logged conditions. Some of the crops suitable in water logged conditions with high water table are:

1. Rice: Rice plant are well adapted in water logged conditions. Seed germination is performed in normal irrigated soils. Thereafter, the seedlings are replanted in water logged soils.
2. Sugarcane: Sugarcane is a biennial crop. It is grown by stem cuttings. The plants can tolerate moderate water logged conditions.
3. Sorgham: Sorgham belongs to grasses which are adapted for moderate water logging conditions. However, during long time water logging the plants growth is affected. By improving irrigation practices and proper drainage, the crop can be grown in moderately waterlogged soils.

MANAGEMENT OF WATER TABLE THROUGH CROP SELECTION

In the regions where the water table is very high I.e. close to the soil surface is very challenging for the farmers. It often leads to water-logging, root oxygen deprivation, and poor crop growth. Selecting the right crops is an effective strategy to adapt to higher water tables, as different crops have varying tolerances to waterlogged conditions. Many crops like rice are highly tolerant to higher water table conditions and can be a crop of choice. Here are some strategies for managing higher water table regions through crop selection:

1. Choose Crops Tolerant to High Water Tables:
Many crop plants are well tolerated to water logging conditions created due to higher water table. These crops are:
A) Highly tolerant crops:

Rice (Oryza sativa): Rice is one of the most water-tolerant crops adapted in water logged conditions. It grows well in flooded marshy fields and is often cultivated in areas with high water tables or where seasonal flooding occurs. The soils in these areas are compact with poor percolation.

Kachalu (Colocasia esculenta): Kachalu is a root vegetable that grow well in waterlogged conditions.
Cranberries (Vaccinium macrocarpon): These are commonly grown in areas with a high water table and need consistent water availability to grow.

B) Crops which grow in Moderate Water logged soils:
Some crops can tolerate short-term water-logging or high moisture conditions, but they will not thrive in constantly flooded soils.such crops need some management practices like proper drainage of water.These crops include:

Sugarcane (Saccharum officinarum): Sugar cane plant belongs to grasses and are propagated through stem cuttings. Sugarcane can grow in areas with high water tables, but water-logging should not be prolonged. It tolerates moist, well-drained soils.

Sorghum(Jawar) (Botanical Name- Sorghum vulgare): Sorghum can survive in short-term water-logged conditions.This crop also need proper water drainage in some stages of life cycle.

2. Crop Rotation and Crop Diversification:
Crop rotation and diversifying the varieties of crops can help in balancing the agriculture system with better soil health. These crops are:

Leguminous crops can be planted as part of a crop rotation with water-tolerant crops like rice. Legumes improve soil structure, reduce compaction, and fix nitrogen, which can help in managing soil health in areas with fluctuating water levels. Alternative growing of rice crop with some legume can be a good choice for high water table regions.

3. Agro forestry:
Growing trees with very high water evaporation tendencies at the boundaries of farm field can help in lowering the water table and is one of the best practice for high water table regions.

CONCLUSION

The water table is highly dynamic and fluctuates over time due to seasonal variations, climatic conditions, and human intervention. Water table can very deep of very high. A higher water table refers to the level below the ground surface where the soil or rock is fully saturated with water. In some areas even in arid zones like villages of Charkhi Dadri in southern Haryana is very high though, the water is highly saline. Many factors are responsible for high water table in such areas like Increased rainfall can lead to a rise in the water table as the ground absorbs more water, Flooding or other events that introduce large amounts of water to the soil and reduced groundwater extraction like In southern Haryana, as water being saline is very less pumped out for irrigation. We can manage the higher water table in such regions by growing water tolerant plant species. Many water sensitive plants can be genetically altered for developing water resistance in staple crops. Further studies in this field can provide more viable and sustainable solutions.

REFERENCES

[1]. Bhumbala DR. Salinity and Alkalinity problem of arid regions of India. by CSSRI Karnal, 1978,331-343.
[2]. Kapoor AS. Biodrainage - A biological option for controlling water logging and salinity, Tata McGraw Hill, New Delhi, 2001,315.
[3]. Hamza, M., and Anderson, W. (2005). Soil compaction in cropping
[4]. systems: a review of the nature, causes and possible solutions. Soil Tillage Res. 82, 121–145
[5]. Ahmadi, S. H., and Ardekani, J. N. (2006). “The effect of water salinity on growth and physiological stages of eight Canola (Brassica napus) cultivars.” Irrig. Sci., 25(1), 11–20.
[6]. Minhas PS . Use of tree plantation for water logging and salinity control: an overview and research needs. J. Water Manage,2012;13:169-179.
[7]. https://www.cgwb.gov.in/old_website/GroundWater/GROUND%20WATER%20LEVEL%20SCENARIO_November-12.pdf
[8]. Mutava, R. N., Prince, S. J., Syed, N. H., Song, L., Valliyodan, B., Chen, W., and Nguyen, H. T. (2015). Understanding abiotic stress tolerance mechanisms in soybean: A comparative evaluation of soybean response to drought and flooding stress. Plant Physiology and Biochemistry, 86, 109–120.