International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 10 Issue 7 ǁ July 2022 ǁ PP. 707-710

"A Review Paper on Agricultural Drainage System"

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Abstract
Excess water in the crop root zone soil is injurious to plant growth. Crop yields are drastically reduced on poorly drained soil, and in case of prolonged water lagging, plants eventually die due to a lack of oxygen in the root zone. Water lagging in irrigated regions may result in excess soil salinity i.e., the accumulation of salts in the plant root zone. Artificial drainage is essential on poorly drained agriculture fields to provide optimum air and salt environmental in the root zone. Drainage is regarded as an important water management practice. And as a component of efficient crop production systems. The current project deals with analyzing agricultural drainage for black cotton soil. A live prototype of agricultural drainage system is made for an accurate analysis. This gives the idea about how actually agricultural drainage system works practically on the field. Model consist main pipe lines and sub-lines which transfer the excess water from the field to ditch.

Keywords:*Agricultural Drainage System, tile drainage.*

Date of Submission: 08-07-2022 Date of acceptance: 22-07-2022

I. INTRODUCTION

When irrigation is introduced in an area to improve crop production two important risks on the natural environment are those of water logging and salinization. Drainage can be used to reduce or eliminate these negative effects of irrigation. Agricultural drainage systems usually increase crop yields on poorly drained soils by providing a better environment for plants to grow, especially in wet years. The systems generally help improve field conditions for timely tillage, planting and harvesting.Land drainage, as a tool to manage groundwater levels, plays an important role in maintaining and improving crop yields: It prevents a decrease in the productivity of arable land due to rising water tables; a large portion of the land that is currently not being cultivated has problems of and the Accumulation of salts in the root zone; water logging and salinity. Drainage is the only way to reclaim such land.

II. NECESSITY OF TILE DRAINAGE

i. It ensures that the crop's root system has a good mixture of water and air and that the salt balance in the soil is favorable for plant growth.

ii. If water tables that remain high for longer time can saturate the soil and leave too little oxygen in the soil pores for the root system, damaging the plant.

iii. The soil temperatures are 7 to 14 degrees -F lower than that of similar soil with good drainage. This impedes germination and slows crop growth.

iv. Some alluvial soils have poor natural drainage, and artificial drainage may be needed to remove excess water from an irrigated field. Artificial drainage systems can lower high water tables, keep salts from building up, increase crop yields, and make irrigation successful. In general, farmers have noticed big increases in yield after the installation of a drainage system.

v. To optimize production potential, the water table should be below 3 feet deep for field crops.

vi. Because the soil has little or no permeability, excess water accumulates on and below the surface after rainfall or irrigation.

vii. When the rate of water input is greater than the natural drainage capacity, the water table rises. Coastal areas— where the altitude ranges from 10 to 100 feet above sea level—generally need regional collective drainage systems.

III. HARMFUL EFFECTS OF EXCESS WATER

i. The field will get water logged and the crop cannot get sufficient water and air, as good aeration and warmth in the root zone are essential for proper plant growth.
ii. Bacteria that change organic matter into plant foods cannot get necessary air and warm temperature in the soil.
iii. Desirable chemical reactions cannot take place and nutrient availability is not easily to the plants.
iv. Proper root development and absorption of nutrients is not accelerated.
v. Seed germination is affected due to poor aeration and warm temperature.
vi. Plants affected by diseases and pest attack.
vii. The fine texture soils due to poor permeability the water cannot move downward fast enough and accumulates on the surface, obstructing aeration. In sandy soil if heavy irrigation is given the water will rapidly percolate down and will be wasted.
viii. Due to excess water, leaching losses of fertilizer namely urea, occur and unavailable to the plants. Also, availability of other nutrients affected.
ix. Excess water interferes with inter cultivation; field requires frequent weeding as excess water accelerates weed growth. Due to wetting of land harrowing, earthing -up etc. Get affected and farm implements turn to wear –tear
x. Due to frequent weeding and damage cause to layout it requires more labor for weeding and correction of irrigation layout. As plants/crop affected due to diseases and attack of pests it adds cost of control measure of these diseases and pests.

IV. OBJECTIVES OF THE CURRENT STUDY

i. To study the soil of agricultural land where drainage is needed.
ii. To Model and analyze the agricultural drainage system.
iii. Compare non drainage agricultural land with drained agricultural land.

V. METHODOLOGY

i. Identify the areas on the parcel where water naturally runs off.
ii. Identify the type of drainage to be used (surface or sub-surface).
iii. Calculate the depth, width and length of the drainage system according to the source and amount of water to be removed, the problem that it creates, the permeability of the soil and the type of crop that the measure is intended to benefit.
iv. Excavate the ditches with an inclination that will avoid the accumulation of sediment and allow the runoff to flow at a speed of at least 0.25 m/s.
v. Complement surface drainage with compacted ridges and sub-surface drainage with filler consisting of rocks or gravel in addition to installing runoff pipes.

5.1.1Drainage Design Considerations

A drainage system should be designed to remove excess gravitational water and lower the water table far enough from the ground surface so it does not interfere with plant growth.

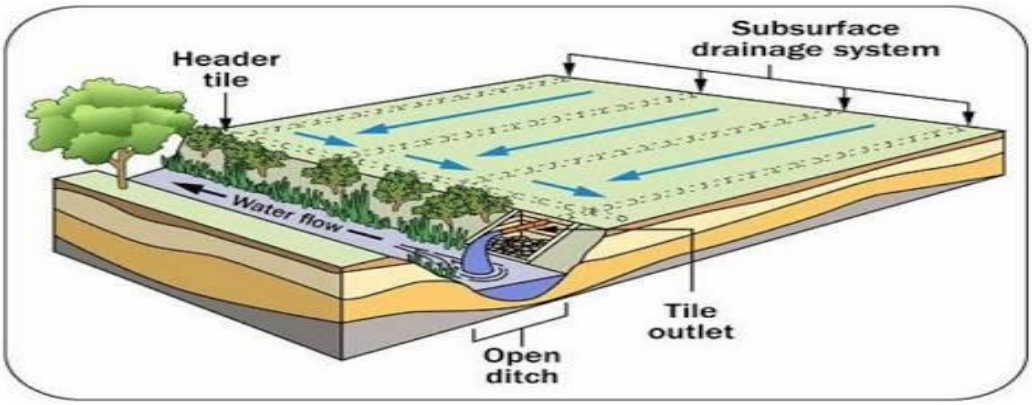

Figure 1: Subsurface Drainage System

Agricultural drainage is carried out by systems that intercept and convey excess water across a plot and dispose of it in a safe location. The water is transported by gravity, in a non-erosive manner, in surface or sub-surface channels. The aim is to control the specific moisture content for each type of crop and avoid losses resulting from excess water in extreme situations. The size of the system depends on the depth of the water table and the maximum volume to be disposed of, but in general channels are between 0.4 and 1.5 m deep and 0.5 and 1.20 m wide. Plastic pipes are buried in the ground to remove the excess water and lower the water tablelaterals are typically installed at a depth of 2.5 to 3 feet. Lateral spacing ranges from 20 to 50 feet for a new installation with the lower range for fine textured soils (clay, clay loams and loams) and the higher range for coarse textured soils (sands and sandy loams). The location of the outlet of a drainage system is important to the proper water-removal function of the system. Choose the outlet with care to allow free flow (unsubmerged) most of the time. Typically, water that flows into the laterals connects to sub mains and a main that conveys the water toward the system outlet. Then the water from the outlet can flow into a stream, drainage ditch ,an existing main or a sump. When the system outlet connects to an existing main, check the capacity of the main to make sure it can handle the water volume. Overall, the subsurface drainage system should be designed to lower the water table from the upper parts of the effective root zone (top 6 to 12 inches) no later than 24 hours after becoming saturated. Significant crop yield

Figure 2: Inspection Chamber

Inspection chamber should be installed whenever a branch pipe meets a main runoff drainage. This will give easy access to continual runs of drainage without needing to use excessive amounts of drain rods.

Figure 3: Prototype of agriculture drainage system

VI. ESTIMATION

Table 1: Total estimate for 1 Acre Land

MATERIAL	NUMBERS	RATE	AMOUNT
PUC Pipe	30	600	18000
Perforated Land Drainage Pipe with Polymers Cover	3 bundles	15000	45000
T-Junction	12	50	600
Jcb	2	1000/h	6000

Labour	10	500	5000
Inspection Chamber	1	6000	6000
Total Cost of Project			80600/-

VII. POSSIBLE OUTCOME

i. Maintaining good field drainage and good soil structure reduces water lagging.
ii. This reduces the likelihood of causing soil compaction through untimely field operations.
iii. This decreases surface run-off, soil erosion and the loss of sediment and associated pollutants, such as phosphorus to water.
iv. Cropping intensity will be increases.
v. Better water infiltration.
vi. Better access to water and oxygen for plant root.
vii. More rapid warming of soil in spring, improving germination.
viii. Better crop uptake of soil mineral nitrogen.

VIII. CONCLUSION

One of the benefits of installing a drainage system to remove excess water is that the soil is better aerated. This leads to a higher productivity of crop land or grassland, also

i. The crops can root more deeply.
ii. The choice of crops is greater.
iii. There will be fewer weeds.
iv. Fertilizers will be used more efficiently.
v. There will be less denitrification.
vi. A properly designed and constructed drainage system removes excess water from the land lowering the water table. It permits aeration of the root zone and warming of the soil when temperatures rise. One of the main reasons for this excess water is when precipitation is far in excess of crop requirements. Crop growth requires drainage.

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