Identification And Demarcation of Water Logging and Saline Land in Nira Left Bank Canal in Malegaon Bk. of Baramati, District Pune

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Abstract-*India is basically an agricultural country and all its resources depend on the agricultural output, water is evidently the most vital element in the plants life. In order to get maximum yield, it is essential to supply the optimum quantity of water. This is possible only through systematic irrigation system. In this paper, an attempt has been made to find out the Water Logging Areas and Saline Land in Malegaon village of Baramati Tehsil. Soil samples were tested from NLBC area of Malegaon village and their Salinity was noted by various laboratory methods like pH test and Electrical Conductivity (EC) mentioned in the paper. It shows that the area of NLBC is alkaline and also some parts are Water Logged due to over-irrigation. The paper includes the environmental impact of Water Logging and Salinity of soil. A provision is being made of providing a Sub-Surface Drainage to minimize the water logging effect. To minimize the combine effect of Salinity and Water Logging on crop yield is recommended to maintain soil health.*

Keywords-Crop yield, Electrical Conductivity (EC), pH, Salinity, Sub-Surface Drainage, Water Logging.

I. INTRODUCTION

Irrigation history has shown that drainage problems in agricultural lands have always followed after irrigation; & state of Maharashtra is not exception to it. In 1888, Nira canals were commissioned for the first time for large-scale irrigation & the land damage problems due to **water logging**&**soil salinity** started cropping up. In June 1916, the special irrigation Division was opened at Pune to investigate the causes and remedies to these land damage problems. Mr. C.C. Inglis, Mr. W.A. Evershed and Mr. V.K. Gokhale carried out fundamental research on different aspects and factors pertaining to land drainage and have laid down guiding principles describing the methodologies for water logging & salinity in irrigated lands. When the agricultural land losses its productivity and becomes less favourable for economical cultivation, it is classified as damage land by common cultivator. The particular moisture of a soil which is best for plant growth is the "Optimum moisture content". It varies for soils of different texture and to small degree for different types of crops. With moisture content in soil at roots of crops exceeding this optimum moisture, the poor spaces become partially failed with water and aeration becomes deficient. Such conditions are unfavourable for plant growth. The result of such conditions is commonly known as waterlogging & termed as damaged land or affected area. Water logging is generally coupled with soil salinity. These are two irrigation hazards which are responsible for damage to the agricultural lands in the command areas. In technical paper 56 by sir C.C. Inglis, Mr. W.A. Evershed, it has been reported that, "Experience indicates that a depth of 4 feet of unsaturated soil is ordinarily be sufficient for the expansion and growth of the root systems of crops in general." The water and land management Institute, Aurangabad has also studied the root systems of various full grown crops, and the average depth of root zone for most of the crops grown in canal command areas of Maharashtra State fall within 1.2m. Hence, the agricultural land is said to be damaged to water logging when the ground water table is within 0 to1.2 m from ground level.

Water logging and salinity are frequently observed problems near the canal. Thus, for the effective operational planning and management of the irrigation system, curative remedies for demarcation of land is very important. In the present study the simplified methods are considered. Various methods are applied to identify the **water logged areas** and **salinity of soil** in the command areas of **Nira Left Bank Canal**(**NLBC**).

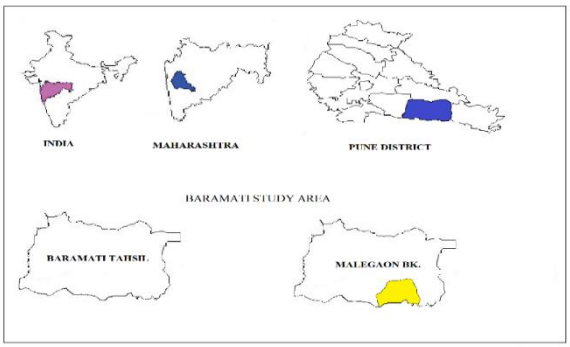


Fig. 1.1 Location Map of Study Area

II. PROBLEM

Due to over irrigation, excess use of chemical fertilizers, changes in the soil conditions leads to the problems of **Water logging** and **Salinity of soil** which indeed results in the decrease in crop yield and income of farmers. This are the two major problems seen in the command areas of NLBC.

III. OBJECTIVE

1. To demark the saline soil conditions and waterlogged lands in command areas of NLBC.
2. To minimize the Water Logging and Salinity of soils.
3. Give suggestions to maintain the soil nutrients to increase crop yield.

IV. METHODOLOGY

First, we carried out entire visual survey of canal then divided the particular most critical path of approximately 3 kms. to carry the detailed investigation and survey work for identification of the water logged areas and saline lands.

Identification of Water Logged Areas:

Based on the water levels in the wells, the areas are classified as

- **Fully water logged areas**
- **Partially water logged areas**

Water logged areas are identified by Observing water levels in the existing wells in the canal command areas by taking 10 cm diameter auger holes, if the number of wells in the area is inadequate well water levels are observed twice in a year i.ePre-monsoon (**March-April-May)** And Post-monsoon (**November-December-January)** Period. In addition to well water level observation, such areas are identified where the water level has already reached the ground surface. The quality of ground water from selected wells in the canal command areas is tested after every four years for deciding its suitability for irrigation based on its pH value.

Demarcation of Water logged Areas:

All areas where the water table in **within 2.00 m.** from the ground surface is classified as ***"Slightly or Partially Water Logged Area"*** and the areas where the water table is between **2.01 m to 3.00 m** from the ground surface is classified as ***"Fully Water Logged Area."***

Identification of Saline Land:

Saline soils in Maharashtra state generally contain excess amount of soluble salts like Sodium Chloride, Sodium Sulphate, Calcium Sulphate, Calcium Chloride, magnesium Chloride and Magnesium Sulphate.

For soil salinity, visual inspections and laboratory tests like pH value test and Electrical Conductivity (EC) tests are adopted.

- VISUAL INSPECTION:

The soils often have white patches on land or there is a white line of salts along the unlined fields.

- LABORATORY TESTS:

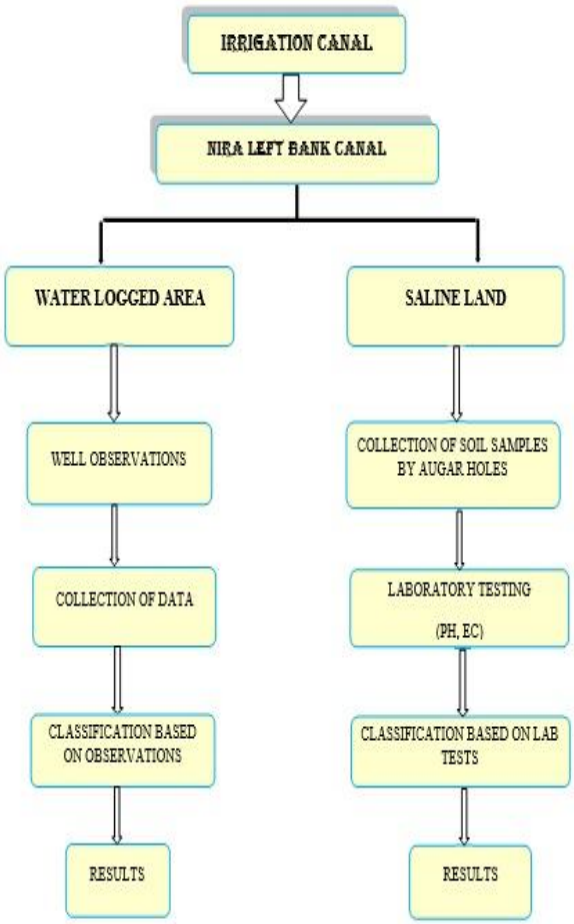
With the help of auger holes, soil samples are collected from the command areas of canal. These holes are digged at a depth of 1.2 m from the ground surface. Each of 20 gm of soil samples are collected at levels of depth of 0 to 0.2 m, 0.2 m to 0.4 m, 0.4 m to 0.8 m, 0.8 m to 1.2 m respectively in four layers. In lab, these samples are treated with the KCl solution and then by using the pHmeter the pH of the soil sample is obtained. Keeping the sample undisturbed for 15 – 20 mins, the electrical conductivity of the soil sample is also obtained using the EC meter.

Demarcation of Saline Land:

Saline land is classified mainly into three types based on its electrical conductivity(EC):

- Non saline land- the EC value is up to 1 ds/m.
- Slightly saline land- the EC value is in the range of 1-3 ds/m.
- Fully saline land- the EC value is more than 3 ds/m.

flow chart of the work:



Water level observation by Pits-Village- Malegaon Bk.

Sr. No.	Survey No.	Water level in Meters					Partially Water-logged
		Well Obs.	Pit No.				
			1	2	3	4	
1	124	2	2.1	2.06	2.04	2.08	0.35
2	305	1.4	2.05	2.08	2.07	2	0.2
3	334	1.5	2.07	2.03	2.04	2.1	0.3
4	361	1.3	2.1	2.06	2.1	2	0.35
5	14	1.5	1.48	1.42	1.5	1.5	0.2
6	19	2	1.45	1.48	1.43	1.47	0.35
7	019/1	1	1.43	1.5	1.4	1.5	0.2
8	119/1	1.8	1.4	1.43	1.46	1.41	0.224
9	122	1.8	1.45	1.43	1.47	1.5	0.3
10	21	1.4	1.5	1.46	1.41	1.42	0.34
11	165	1.6	1.43	1.48	1.5	1.44	0.3
12	198	1.7	1.48	1.46	1.41	1.5	0.2
13	210	1.2	1.5	1.46	1.43	1.4	0.3
14	240	1.3	1.46	1.45	1.5	1.43	0.2

Table No.1

Results of Soil Samples Collected from Augar Holes for Saline Land-Village- Malegaon Bk.

Lab No.	Survey No.	Pit No.	Depth in Cm.	pH	Conducti-vity in mm/hod/c/cm	Remark
737	134	185	0-20	9.36	0.57	SS
738			20-40	9.8	4.29	
739			40-80	9.98	1.27	
740			80-120	9.32	1.77	
741	135	186	0-20	8.85	1.71	SS
742			20-40	8.41	1.35	
743			40-80	8.98	3.39	
744			80-120	9.19	1.31	
745	136	187	0-20	9.09	1.89	SS
746			20-40	9.03	2.66	
747			40-80	8.96	3.79	
748			80-120	9.88	3.54	
749	137	188	0-20	9.77	3.46	FS
750			20-40	9.88	5.58	
751			40-80	9.8	7.3	
752			80-120	9.6	7.6	
753	140	189	0-20	9.9	3.12	SS
754			20-40	9.2	1.56	
755			40-80	8.76	1.78	
756			80-120	8.54	0.87	

Table No.1

V. ENVIRONMENTAL IMPACT OF WATER LOGGING AND SALINITY

The environmental implications of water logging and salinization are far reaching and devastating. These can be primarily divided into four categories as follows:

1. Soil modifications
2. Socio- economic impacts
3. Public health
4. Effects on Flora & Fauna

Soil Modifications: Water logging occurs when ground water saturates the plant root zone. The impact becomes more severe when waterlogging is coupled with salinity. When this occurs as the water table rises under waterlogging conditions, salts concentrated beneath the root zone are dissolved and carried to the root zone or the surface. Since, the high salt concentrations in the root zone interferes with the movement of soil-water into the roots, plants begin to wither or die when salt concentration is beyond tolerance. Water logging & salinity due to over irrigation may also change the texture of the soil. Thus, this is a serious

environmental implication, which is directly related to economic yield of crops.

Socio- economic impacts: Since the water logging and salinity affect the soil productivity very adversely, it is needless to emphasize that it will have an eroding impact on Socio- economic aspects of the NationPublic health: The secondary effect of waterlogging and salinity is that excess amount of water, loaded with residual chemical fertilizers and pesticides, flows through natural nallas and rivers thus making the water harmful for the health. Thus, quality of water is deteriorated. Water is favourable medium for spread of diseases, carrying bacterial and viral pathogens.

Effects on Flora and Fauna: Waterlogging provides a constant moist environment within soil. Native plants have reproductive adaptations, which depends on the particularities of arid and semi-arid climates for germination. These will no longer flourish with the constantly moist fields. Proliferation of salt resistant algae and water weeds caused by elevated water levels and increased nutrient loads from fertilizers further make an aggressive impact on local flora and fauna.

VI. PROVISION

Sub-Surface Drainage System

Surface drainage refers to the removal of surface water by development of the slope of the land utilizing systems of drains to carry away the surplus water.

The Process of directing excess water away from the root zones of plants by natural or artificial means, such as by using a system of pipes and drains placed below ground surface level.

In subsurface drainage open ditches and tile fields intercept groundwater and carry it off. Surface drainage systems are usually applied in relatively flat lands that have soils with a low or medium infiltration capacity, or in lands with high-intensity rainfalls that exceed the normal infiltration capacity, so that frequent water logging occurs on the soil surface. Subsurface drainage systems are used when the drainage problem is mainly that of shallow water tables. When both surface and subsurface water logging occur, a combined surface/subsurface drainage system is required. Sometimes, a subsurface drainage system is installed in soils with a low infiltration capacity, where a surface drainage problem may improve the soil structure and the infiltration capacity so greatly that a surface drainage system is no longer required. On the other hand, it can also happen that a surface drainage system diminishes the recharge of the groundwater to such an extent that the subsurface drainage problem is considerably reduced or even eliminated. The choice between a subsurface drainage system by pipes and ditches or by tube wells is more a matter of technical criteria and costs than of agriculture criteria, because both types of systems can be designed to meet the same agricultural criteria and achieve the same benefits. Usually, pipe drains or ditches are preferable to wells. However, when the soil consists of a poorly permeable top layer several meters thick, overlaying a rapidly permeable and deep subsoil, wells may be a better option, because the drain spacing required for pipes or ditches would be considerably smaller than the spacing for wells.

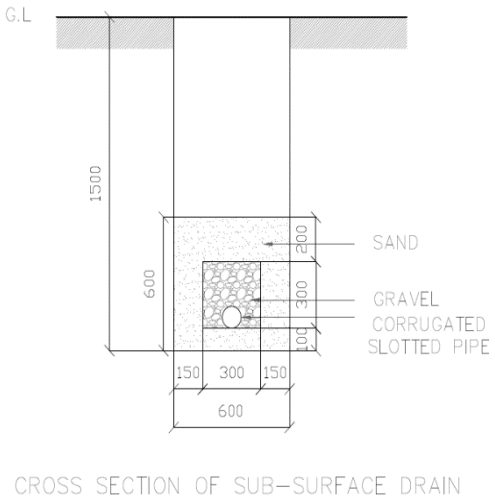


Fig No.2

VII. RESULTS AND DISCUSSION

In the present survey, it is found that the water logging is a major problem in the study area. This is all due to rising of water table. This excess water is made available to the soils through canals. As a result, there is continuous accumulation of underground water year after year. A large number of factors are responsible for water logging. These include seepage from unlined earthen canals system, inadequate provision of surface water drainage, poor water management practices, and use of poor quality (highly saline in study area) groundwater for irrigation.

From the survey it was found that the command areas of NLBC are Partially-water logged i.e. the depth of water table is within 2 meters.

In our study area, village Malegaon Bk. found highest pH percent in weakly alkaline (7.4 to 7.8 pH value) category i.e. 23.96% which concludes that the nature of soil is SS (Slightly Saline).

After Electrical Conductivity (EC)test it is found that, most of the soil is NS (Non-Saline) i.e. its EC value is up to 1 ds/m.

VIII. CONCLUSION& RECOMMENDATIONS

Most of the area of Malegaon village is Slightly Saline whose EC value is between 1 to 3 decisiemens/m. The command areas of NLBC are partially Water Logged. These areas cannot be used for irrigation purposes. There is a high cultivation of Sugarcane crops which leads to soil salinity. In some areas, fully saline lands are also observed.

Water logging is directly related to salinity. Evaporation of water in summers can result in accumulation of salts on the surface and root zone. Thus multiple approaches are needed to tackle the problem. Optimum use of irrigation water at appropriate time with proper dose of fertilizers can reduce the outbreak of waterlogging and soil salinity.

Farmers participation in drain maintenance is very important. Proper crop rotation techniques should be practiced.

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