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Cultivating Productive Water in Valukai Aru Catchment in Valikamam Division of Jaffna District of Northern Sri Lanka

Visnuvarthanan, N [1] and Sivakumar, S.S.,[2]

Abstract— *Valukaiaru is a wet weather drainage scheme in the Jaffna peninsula. It is situated in the middle part of the Valikamam division. Valukaiaru basin has a total area of 57 sq. km covering the District Secretariat (DS) divisions of Tellipalai, Sandilipay, Chankanai and Uduvil. Valukaiaru scheme consists of a main drainage channel, eight tributary drainage channels and 65 minor tanks. The last control gate of this scheme, the Arali barrage is situated at the end of the channel at Arali. Valukaiaru starts from the village of Kurumpaciddy in Tellipalai DS Division and mixes with sea at the Arali barrage. Sea water intrusion through the damaged Arali barrage caused salinity problem in the soil and water resources of the Valukaiaru basin. Irrigation Department commenced the project on Rehabilitation of Arali barrage in 2008. By the renovation of Arali barrage sea water intrusion into the cultivable area through Valukaiaru has been stopped. Prevention of sea water intrusion significantly reduced the salinization of cultivatable lands and practicing effective water management will improve the productivity of the Agricultural Lands. The main causes that contribute to the low productivity of water and soil is improper management of water and agricultural practices, inadequate utilization of rainfall & sea water intrusion. More water is spilling without usage as there is not adequate capacity of tank although there is enough high and low lands for cultivation. This article analyses the problem and spell out a possible research solution to improve the water productivity of Valikamam.*

Index Terms— Productive *Water, Rehabilitation, Barrage, Salinity intrusion, Water Management*.

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1 Introduction

SALINITY is one of the major constraints that limiting the expansion of cultivated areas and diminishing the productivity of rice lands in Sri Lanka. Saline soils mainly occur in irrigated inland areas of the dry zone and coastal areas of Sri Lanka. Salinity is induced by insufficient drainage facilities (Jeganathan and Adamplan, 1980; Balasooriya, 1987). Severe salinity levels are recorded in areas where evaporation exceeds precipitation (Sirisena et al, 2010). During dry weather, salt water intrudes into lands up to 50 cm above mean sea level (Panabokke,1977) and as a result rice growing soils in the coastal belt of Sri Lanka are salinized annually (Dimantha, 1977).

In Sri Lanka, the total area affected by coastal salinity was estimated around 0.112 million ha (De Alwis and Panabokke, 1972). Further, approximately 4000 ha of costal rice soils were flooded with salt water during the 2004 Indian Ocean tsunami, resulting in salinity and making those lands unsuitable for rice cultivation. Extreme environmental conditions and the rising sea level due to climate changes are also expected to bring about further increases in the salinity of rice fields (Dimantha, 1977).

- [1]Research Student, University of Jaffna, Thirunelvely Jaffna, Sri Lanka,
- [2]Head of Department and Senior Lecturer, Department of Civil Engineering, Faculty of Engineering, University of Jaffna, Kilinochchi, Sri Lanka,PH (+94) 772508730; email: sssivakumar@jfn.ac.lk

Saline soils vary widely in their chemical and physical properties. The parameters that affect the salt content of the land are nature of salts, the distribution of salts in the surface horizon, the soil pH, the nature and content of clay, the organic matter content, the nutrient content, the water regime relief and the temperature (Ikehashi and Ponnamperuma, 1978). Thus, the remedial measure to minimize salinization can't be practiced across the different areas in similar ways. There are several remedial measures followed by farmers. The Jaffna peninsula lies in the northern-most part of Sri Lanka. The under groundwater is used for all purpose of water requirements. There is no any stream flows throughout the year in Jaffna peninsula.

The surface stream, Valukai Aru, is active only during the height of the monsoon, and there are no reservoirs of a perennial nature Valukaiaru is a wet weather drainage scheme in the Jaffna peninsula (Punthakey and Gamage, 2006).

It is situated in the middle part of the Valikamam division. Valukaiaru basin has a total area of 57 sq. km covering the District Secretariat (DS) divisions of Tellipalai, Sandilipay, Chankanai and Uduvil. Valukaiaru scheme consists of a main drainage channel, 8 tributary drainage channels and 65 minor tanks. Valukaiaru starts from the village of Kurumpaciddy in Tellipalai DS Division and ends at sea at the Arali barrage. The length of the Main channel of the Valukaiaru is 16.01 km.

The water of the Valukaiaru is used for agricultural activities of 37 selected villages. The Valukaiaru scheme consists of paddy land, cultivable high lands, homesteads and several other land uses. There are about 21,241 families in the areas

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benefited by Valukaiaru Scheme. Total paddy land area is 1974 ha and the total high land area is 303 ha. About 67 ha of paddy land have been abandoned due to the problem of soil salinity. About 13 ha of high land have been abandoned due to the salinity.
Sea water intrusion through the damaged Arali barrage caused salinity problem in the soil and water resources of the Valukaiaru basin. Irrigation Department commenced the project on Rehabilitation of Arali barrage was carried out in the 2008. By the renovation of Arali barrage sea water intrusion into the cultivable area has been arrested. Prevention of sea water intrusion significantly reduced the salinization of cultivatable lands. Anyway there are complaints by farmers regarding salinity problem in these areas in recent past.

2 Problem Statement of Research

Sea water intrusion through the damaged Arali barrage caused salinity problem in the soil and water resources of the Valukaiaru basin. Irrigation Department commenced the project on Rehabilitation of Valukaiaru scheme in the latter part of 2008 to renovate the Valukaiaru irrigation scheme. By the renovation of Arali barrage sea water intrusion into the cultivable area has been arrested. Prevention of sea water intrusion reduces problem of soil and water salinity.

Conservation and effective management of water in the drainage channels and minor tanks improves the recharge of ground water and facilitates development of agriculture and livestock sector.

Efficient water management practices will convert this unproductive salinity affected land into productive land. Therefore the water management practices very much important for this study.

3 Objectives of the Research

Main objective of this study is to identify the management lapses in utilizing available water and spell out good agricultural and water utilization concepts.

The specific objectives of the proposed research are

- Demarcate the boundary of the Valukai Aru scheme.
- Classify the crop fields based on the severity of the salinity in both Yala & Maha season among the agricultural fields receiving water under "Vallukai Aru" scheme.
- Identify the present network problem in the Valukai Aru scheme.
- Identify the different water management methods adopted by farmers to overcome salinity issue in the scheme.

4 Review of Literature

In the twelfth century, King Parakrama (1153 – 86) had said: **"Not a single drop of water received from rain should be allowed to escape into the sea without being utilized for human benefit".** Sri Lanka is endowed with a hydraulic civilization natured by a rich Irrigation Heritage. We are committed to keep these traditions alive by the development and management of the water and land resources for sustainable use. There is not a water shortage in Sri Lanka but, in a monsoon climate, the challenge is to manage the available water.

According to SS Sivakumar (2015) Review Report on Jaffna Kilinochchi Water Supply and Sanitation Project, Jaffna is a peninsula which is 1000 km2 of land (out of which, Vadamarachchi Lagoon, Upparu Lagoon, Valukaiaru and Elephant pass Lagoon are covered with 75, 25, 15 and 100 km2 of surface area and 287, 212, 104 and 907 km2 of catchments area, respectively) covered by Indian Ocean by 160 km of coastline and no location is more than 10 km away from the coast. Hence it is very much susceptible to the salt water intrusion in to the land area.

The water resource mainly the underground water in Jaffna Peninsula is totally polluted due to prolonged negligence and improper management of existing barrages at Thondamanaru, Ariyali and Ariyali and the salt water intrusion was taken place due to the none- maintenance of SWE bunds. In addition to these garbage and soakage pit pollution and increased usage of fertilizer chemicals also affected the ground water. As a result, people are facing problem in getting good quality water in their wells. Due to the salt water intrusion, hundreds of acres of lands, hundreds of wells are in abundance state.

Modifying water management through appropriate irrigation practices can often lead to increased crop yields under saline soil conditions. Most plants require a continuous supply of readily available moisture to grow normally and produce high yields. After irrigation the soil moisture content is maximum and the salt concentration or the osmotic pressure of the soil solution is minimal it is favorable for crop growth. (Nielsen et al, 1966)

As the soil progressively dries out due to evapo-transpirational losses the concentration of salts in the soil solution and its osmotic pressure is increase. It's making the soil water increasingly difficult to be absorbed by the plants. Thus infrequent irrigation aggravates salinity effects on growth.

On the other hand, more frequent irrigations, by keeping the soil at higher soil moisture content prevent the concentration of salts in the soil solution and tend to minimize the adverse effects of salts in the soil. (Nielsen et al, 1966)

Irrigation method can play an important role in controlling salts in the root zone. It has been discussed that frequent irrigations are helpful in saline soils in maintaining adequate availability of soil water. Sprinkler irrigation is an ideal method for irrigating frequently and with small quantities of water at a time. Leaching of soluble salts is also accomplished more efficiently when the water application rates are lower than the

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infiltration capacity of the soil and such a condition cannot be achieved by flood irrigation methods. In a field experiment (Nielsen et al, 1966) flood irrigation required three times as much water as sprinkling to reduce soil salinity by the same increment. Sprinkler irrigation also has the advantage that small local differences in the level of the field will not cause non-uniform water application and salt leaching.

During periods of high evapotranspiration between the two irrigations and during periods of fallow there is a tendency for the leached salts to return to the soil surface. Soil salinization is particularly high when the water table is shallow and the salinity of groundwater is high.

Any practices that reduce evaporation from the soil surface and/or encourage downward flux of soil water will help to control root zone salinity. Sandoval and Benz (1966) and Benz et al (1967) studied soil salinity changes as effected by bare fallow and straw mulch on fallow over a three years period. Their results showed that on bare fallow soil mulch should be maintained to induce salinity reduction.

Studies are intended to show the current state and development of a subject in a country. Sometimes they analyze the scientific output of the country as a whole. In some cases the analysis sheds light on a particular nation's authors. The findings indicate distribution and growth of the scientific production of a county. Mostly these kinds of studies conducted a descriptive bibliometric analysis of content, trends, and patterns found in number of contributions of a particular subject field.

5 METHODOLOGY

The research method of this will be mainly collecting field data, analytical method that adopts detailed analysis of secondary data, mappings using GIS as one of the technique and formulas along with statistical techniques. The following will be in narration.

- Demarcate the boundary of Valukai Aru scheme:
  GPS will be used to demarcate the Valukai Aru scheme boundary and all the main and distributor channel system. Land use and drainage map will be developed. Arc GIS software will be used for the above.

- Entire study area will be divided as grids of 1Km 2 and 9 random soil, dug well and surface water sample will be collected from each grid during yala and maha seasons

- Electric conductivity (EC) of each sample will be obtained and A pretested structured questionnaire will be used to collected data related to:
  - Maintenance of Valukai Aru network
  - Mainer tank management related to Valukai Aru
  - Maintenance of Valukai Aru sluice gate
  - Cultivation history
  - Incidence of soil salinity and its severity
  - Remedies adopted by farmers to overcome soil salinity
  - Other related information
- Information collected from reports of related studies and discussions with stakeholders & Annual rain fall data will also utilize to drive the conclusions.

7 DATA COLLECTION AND ANALYSIS

The following data will be collected for this research

- 1:10000 scale area Map
- Primary data collection through questionnaire survey.
- Secondary data collection from related studies in the scheme
- Information collection through the interview with the stakeholder.

With the collected field data the following parameters will be analyzed

- Soil, Dug well and Surface water salinity analysis
- Tabulated data will be analyzed by using appropriate statistical package.
- Arali barrage operation

6 BENEFITS OF THE RESEARCH AND CONCLUSIONS

Although this study will facilitate to understand the salinity problem hoe to affect the agricultural field as well as the Irrigation water. The Management of Valukai Aru Scheme and improvement of Mainer Tank management related to this scheme will reduce the salinity and increase the total production of the land. With implementing the output of this research it is expected that cropping intensity, yield and the area that can be cultivated during Maha and Yala will increased. To improving the capacity of Mainer tank can be contributing to High Land and paddy land cultivation and also possible by Lift Irrigation system and Ground water also will be enriched. By Improving of water management, the standard of living of farmers in Valukai Aru scheme will be increased.

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