Chapter – I

Introduction
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INTRODUCTION

Agricultural performance is fundamental to India’s economic and social development. Agriculture contributes 22 per cent of GDP, 60 per cent of employment and is a primary source of livelihood in rural areas which accounts for 72 per cent of India’s population. During 2009-10 Agricultural growth of India has been at the lowest level of 0.4 percent and it is expected to grow at 4 per cent 2010-11 (Central Statistical Organisation Report 2010).

Water is becoming a looming crisis affecting domestic, industrial and agricultural sectors. By 2025, scarcity of water would threaten 30 percent of the human population as 70 percent of the water withdrawals are used in irrigated agriculture globally.

Africa and Asia had already experienced an increasing shortage in per capita water availability. Irrigation demand is expected to increase keeping pace with the need to increase agriculture production. Irrigated agriculture needs to be increased by 23 million hectares i.e., 19 percent over and above the area lost under water logging and Salinization. The majority of the area would fall in South Asia. The changes of disastrous crop failures have been used in many countries through the expansion of irrigation. The irrigation economics is concerned with two divergent trends in water use pattern.

On the one hand the demand for water is increasing for household, agriculture and industrial purposes. On the other hand there is sever depreciation in the quantity and quality of water available to feed the ever growing demands of the society. This has resulted in the water crisis. The crisis is aggravated by injudicious use of water by people and ineffective management of project authorities. The present share of irrigation in the total water resources annually utilized in India is 83 percent and it is expected to be in the region of 79 percent 2050. A study conducted by Veeraiah and Madan Kumar (2008) pointed out that water entering upper-ganga canal, as much as 44 percent was lost in canal, in distributaries and in village water courses.
Of the remaining 56 percent actually entering the field, the farmer wasted another 27 percent in excessive irrigation and thus the water actually used by crops was only 29 percent. Other researches conducted in various parts of India unambiguously have been showing there is large amount of inefficiency in water used by the farmers.

This calls for judicious water management practices in storage, delivery, technology, knowledge, agronomic practices, water use charges and stakeholders. Hence an economic analysis of water use efficiency of farmers in Pullambadi canal of Tiruchirappalli and Ariyalur districts is worth researchable.

STATEMENT OF THE PROBLEM

The monsoon rain viz., South West monsoon and North East monsoon determines water resources of the states. But the monsoon is highly erratic and fails at times. Tamil Nadu is the second water starved state next to the state of Rajasthan, which does not have any perennial river. Further, Tamil Nadu with 7 per cent of the population of the country and 4 per cent of land area is endowed with 4 per cent of fresh water resources in India.

The water use efficiency is of paramount importance in the years to come. The major problem is the conservation of rainfall received. Surface runoff, evaporation, infiltration and deep percolation account for the total volume of the rainfall received and stored. The run-off coefficient of a basin normally depends on the mean temperature, humidity, pattern of rainfall, intensity of rainfall, vegetation and topographical features of the basin. According to Kumaraswamy (1974), the run-off coefficient is found to vary between 0.40 and 0.55 in Tamil Nadu.

There is a mismatch in the water use in India. The demand for water is increasing tremendously due to continuous surge of population, urbanization and industrialization. But the availability and supply of water are relatively inelastic especially in Tamil Nadu. This calls forth judicious water management policies and practices among the stakeholders.

In this context India has the lowest water use efficiency of 30-40 per cent against 55 per cent in China. The poor water use efficiency is the result of lack of scientific irrigation and cropping pattern. According to various studies, India can
augment the water use efficiency by 40 to 50 per cent by implementing better use of conveyance, delivery and allocation. In India, many irrigational projects have yet to reach even 50 per cent of the irrigation potential.

Here an attempt is made to study the water use efficiency and practices of the farmers of Pullambadi canal, Tiruchirappalli and Ariyalur districts. For the sake of better analytical convenience, the gross area under irrigation is divided into three regions viz., 1. The area where the canal originates 2. The area which lying in the middle of the gross irrigated area and 3. The tail-end area of irrigation. A comparative analysis of those regions with respect to their irrigation potential and its likely impact on the farming practices were investigated to prepare a blueprint for better and efficient water use management for the study area based on the finding of the study.

Economic aspect of water use efficiency is farmer’s interest to improve economic return from the investments in irrigation water supply.

The water use efficiency is measured in terms of input efficiency by two methods

a) The ratio of yield to supplementary cost incurred by the farmers for irrigation and
b) The ratio of yield to prime cost incurred by the farmers for irrigation

The measurement of water use efficiency is based on the cost benefit aspects of water used by the farmers in the study area.

**SCOPE OF THE STUDY**

The general inadequacy of irrigation water and growing demand for crop production including remunerative cropping in modern times needs a systematic study of irrigation problems and methods of efficient and economic use of water. Since irrigation potential is created at a huge cost, it is necessary to derive maximum benefit from the created potential, often a gap exists between irrigation potential created and its utilization that makes the situation more serious. A large amount of water is wasted in conveyance and distribution systems where lining of canal, distributaries and water courses has either not been undertaken or has been ill-maintained.

Improper irrigation scheduling, land grading and leveling and faulty method of irrigation lead to waste of water in crop land.
Irrigation, being one of the important inputs of agriculture, becomes an equally important component of the rural infrastructure for the development. Hence, in any planning for development sufficient weightage has to be given to irrigation development. It is much so in the case of a country like India where agriculture sector is the main stay of the national economy, provides employment for a major part of the population and sustenance to about 70 per cent of it, and yet by and large it depends on the vagaries of monsoon.

The main function of irrigation is to mitigate the impact of inadequate and irregular rainfall, with wide fluctuations from year to year, which often results in even semi-famine conditions. Water is becoming increasingly scarce and most of the Asian nations including India are expected to face serious water scarcity in the next 10-15 years thus, threatening the sustainability of irrigated rice production in Asia.

Currently the irrigation efficiency in canal and tank irrigation system in India is only about 30-40 per cent and in well irrigation it is about 60-65 per cent. On an average only 40-45 per cent of irrigation water is actually used by the crop. The water use efficiency can be considerably increased in canal water irrigation in India, since the inefficiency level is 55-60 per cent. It can be substantially reduced with proper irrigation management practices. Hence a study on water use efficiency by the farmers assumes a greater significance in the Pullambadi canal of Tiruchirappalli and Ariyalur districts, Tamil Nadu.

OBJECTIVES

The main objective of the present research is to examine the canal water utilization of the farmers in the study and following are the specific objectives of the research.

i) To examine the cropping pattern of the farmers and the factors influencing the shift in the cropping pattern

ii) To study the factors responsible for the adequacy and inadequacy of water available to the farmers

iii) To examine the various causes of water wastages and the measures needed to arrest the wastages

iv) To analyse factors determining the water use efficiency of the farmers
v) To study the role of Water Users Association in augmenting the water use of the farmers and

vi) To suggest appropriate policy measures to enhance the water use practices of farmers.

HYPOTHESES

The following are the hypotheses formulated to probe deeply the objectives of the study.

i) Water related problems are more decisive in determining the cropping pattern of the farmers than non-water related problems.

ii) The water use efficiency differs widely among the farmers in the study area.

iii) There is a significant variation among the farmers with regard to the functioning of Water Users Association and

iv) The methods pursued by the farmers in the three regions in mitigating water shortages are quite distinct.

METHODOLOGY

The study is an evaluative study to examine the water use efficiency of the Pullambadi canal. The focus of the study is the water users of the Pullambadi canal. The sample respondents are selected at three levels. The sample responders who are at the origin of the Pullambadi canal forms the first level, the sample respondents who are at the middle of the Pullambadi canal form the second level and the tail-end farmers using the canal water formed the third level. Simple random sampling is administered to select the respondents in the study area. Weighted random sampling is used. Weighted sampling is used to select the respondents in equal number from the three regions.

The first region (Head region) depends predominantly on Pullambadi canal, the second region (Middle region) relies on both Pullambadi canal water as well as on lakes and tanks and third region (Tail-end region) exclusively depends ground water and lakes and tanks which receive water from Pullambadi canal. The divergent irrigation practices of the farmers facilitate the researcher to go for weightage sampling to select 100 samples equally from all the three regions. Voters list are
used to identify the respondents in those areas and village records maintained by Village Administrative Officers and sample respondents are selected through Tippets table of random numbers.

To elicit information from the respondents about water use a well structured comprehensive questionnaire is drafted. The data related to inflow and outflow of water, storage of water are collected from the Executive Engineer P.W.D. R.C. Division, Tiruchirappalli-1 and Junior Engineer, P.W.D. Pullambadi Canal / Section, Thirumanur.

The sample respondents are selected from the areas irrigated by Pullambadi canal from its origin to till end. The revenue villages covered by the Pullambadi canal and are arranged in the ascending order of magnitude. The revenue villages coming under the Pullambadi canal are categorized on the basis of availability and use of water in to three categories viz.,

1. The Head Region
2. The Middle Region and
3. The Tail-end Region

From the Head Region, revenue villages are selected at random and from the revenue villages farm households are selected by random sampling method. The same procedure is followed in middle and tail-end Regions. From the three regions apportioned on the basis of the water availability, 100 farm house holds are selected randomly from each segment. The total size of the sample thus constitutes 300.

**Sample Distribution**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Area</th>
<th>Revenue Villages</th>
<th>Households Selected from each village</th>
<th>Size of the sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Head</td>
<td>5</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>Middle</td>
<td>5</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>Tail-end</td>
<td>5</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15</strong></td>
<td><strong>60</strong></td>
<td></td>
<td><strong>300</strong></td>
</tr>
</tbody>
</table>
A well structured schedule is prepared to collect information about water use practices of the respondents. Direct Interview technique is administered to elicit information from the respondents. The interview method is the most appropriate method of collecting information since cross checking and observations are possible under this method.

PERIOD OF STUDY

The study covers a period of 2009-2010. It covers all the three seasons of agriculture viz., Kuruvai, Thaladi and Samba. But this area is characterized by only single crop (paddy) and one season (Samba) only.

STATE OF THE ART

This descriptive study is focusing on well defined objectives. The research design is prepared keeping in view with the objectives of the study and resources available. The study ensures maximization of objectivity and minimization of subjectivity arising out of bias and personal prejudices. The state of art of this research work is referred to as a survey design and it takes into account all the four aspects of overall Research design.

i) Sampling design: Probability sampling design. The work is carried out with the help of sample respondents chosen on the basis of simple random sampling. The size of the sample is 300 which of equally apportioned in all the three regions viz., Head region, Middle region and Tail-end region.

ii) Statistical design: Pre planned design for analysis of data is utilized. SPSS is used to test the hypotheses and reduce the data. (data reduction techniques)

iii) Observation design: A comprehensive and a well structured schedule is prepared by the researcher to elicit information from the respondents.

iv) Operational design: A well thought out operational procedures are laid out.

STATISTICAL TOOLS USED FOR ANALYSIS

The primary aim of the study is to estimate the water use efficiency of farmers of Pullambadi canal in Tiruchirappalli and Ariyalur Districts. The computation involves Costs Benefits analysis of water used by farmers in the study area. The economic interpretation of water use efficiency is attempted in this research work.
The costs involved in acquiring and using water is measured in monetary terms and
benefits from water by the way of yield is also measured in terms of money. The Cost
Benefits ratio is computed for the head, middle and tail-end regions of the study area.
Since the study involves indepth analysis of behaviour of farmers in using water
Cross tabulation is widely used. For comparing the above mentioned regions Chi-
square test and Analysis of Variance (ANOVA) are used. These tools used to explain
the variation in the water availability, cropping pattern and to find the differences of
opinions among farmers in the successful functioning of Water Users Association.
The Non Parametric Friedman Ranking test is used to rank the factors in exerting
influence on the working of the Water Users Association and the same test is used to
rank the factors responsible for the failure of Water Users Association in the study
area. Multiple Regression is used to indentify the causal relationship between water
use efficiency (dependent factor) and labour cost, fertilizer and pesticide cost, extent
of mechanization and types of seed as independent factors. Simple averages (means)
and diagrams are used to highlight the observations.

LIMITATIONS OF THE STUDY

The study concentrates only on the water use efficiency of farmers in the
Pullambadi canal basin. The flow of water is constrained and regulated by Tamil
Nadu government G O which stipulates the water level at the Mettur reservoir should
exceed 94 feet for releasing the water to Pullambadi Canal. Under this unique
constraint farmers availed and used the water for irrigation purpose in this study. This
rare and distinct situation may not prevail in other agricultural river basins. Hence the
results and policy implications of the study are restricted only to the study area. The
results of the study can not be generalised uniformly to other regions of the country.

The primary objective of this research work is to estimate water use efficiency
of farmers of Pullambadi canal of Tiruchirappalli and Ariyalur districts. There are
various scientific tools used to compute water use efficiency of farmers. It comprises
Conveyance efficiency, Storage efficiency and Allocative efficiency. The researcher
instead of pursuing those efficiencies which are based on engineering concepts,
chosen economic interpretation of water use efficiency. The water use efficiency is
studied through cost benefit analysis and this has not incorporated the engineering and
technical aspects of water use. This study has analysed the water use efficiency from the point of view of farmers but it has not viewed from the point of other stakeholders viz., government, general public and private water bodies.

RESEARCH GAP

The researcher has attempted to study the water use efficiency of the farmers of Pullambadi canal, Tiruchirappalli and Ariyalur districts. Pullambadi canal is a seasonal canal which covers head, middle and tail-end regions. The study is confining with water use of the farmers only for a period from 1st August to 15th December. The future researcher can venture upon water use efficiency of farmers in perennial rivers.

The water use efficiency is estimated only on the basis economic interpretation of water use and no technical methods or techniques are used by the researcher to measure the use of water in physical quantities. The future researchers can measure the use of water in terms of physical quantities.

Another gap in the research is the lack of analytical treatment on capital rationing and optimal cropping pattern. These are the virgin areas on which future researchers can research upon.

CHAPTER SCHEME

The chapterisation is carried out in accordance with the research design of the study.

Chapter I covers Introduction, Statement of the Problem, Scope of the Study, Objectives, Hypotheses, Methodology, Period of Study, Tools used for Study, Limitations of the Study and Chapter Scheme.

Chapter II encompasses exhaustive Review of Literature and Definition of Terms and Concepts.

Chapter III comprises the Profile of the Study Area, Tiruchirappalli and Ariyalur Districts and Area of the Study.

Chapter IV furnishes Analysis and Interpretation of Data.

Chapter V furnishes Findings, Suggestions, Conclusion and Policy Implications of the Study.