A STUDY ON RAIN WATER HARVESTING AND WATER RESOURCE MANAGEMENT ON SELECTED VILLAGES OF TIRUPUR DISTRICT

SELVA GAYATHRI M

(20PEX012)

Thesis Submitted to

Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore – 641043

In partial fulfillment of the requirements for the

Degree of Master of Science in Extension and Communication

May– 2022

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Signature of the Guide

Signature of Head of Department

Signature of the External Examiner

CERTIFICATE

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This is to certify that the dissertation entitled on "**A Study On Rain Water Harvesting and Water Resource Management in Selected Villages of Tirupur District**" is submitted to the Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore–641043 impartial fulfillment of the requirements for the award of the degree of Master of Science in Extension and Communication is a record of original research work done by SELVA GAYATHRI M (20PEX012), during the period of the study in the Department of Home Science Extension Education, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore – 641043, under my supervision and guidance, has not formed the basis for the award of any Degree/Diploma/Associateship/Fellowship or similar title of other University.

Signature of the Guide

Signature of the Head of the Department

DECLARATION

DECLARATION

I **Selva Gayathri M** hereby declare that the thesis, entitled "**A Study On Rain Water Harvesting and Water Resource Management on Selected Villages of Tirupur District** ", submitted to the Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, impartial fulfillment of the requirements for the award of the **Master of Science in Extension and Communication** is a record of original and independent research work done by me during six month under the Supervision and Guidance of **Dr. (Mrs.) R. Jansi Rani**, Assistant Professor (SG) and it has not formed the basis for the award of any Degree/Diploma/Associateship/Fellowship or other similar title to any candidate in any University.

M. Selva Gayathri

SIGNATURE OF THE CANDIDATE

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1. INTRODUCTION

In India ,Tamil Nadu was the first state to make rainwater harvesting compulsory for every building to avoid groundwater depletion. The project was launched in 2001 and has been implemented in all rural areas of Tamil Nadu. Posters all over Tamil Nadu including rural areas create awareness about Rain Water Harvesting. It gave excellent results within five years, and slowly every state took it as a role model. Since its implementation, Chennai had a 50% rise in water level in five years and the water quality significantly improved.(Wikipedia 2022)

Rainwater harvesting in the United Kingdom is a practice of growing importance. Rainwater harvesting in the UK is both a traditional and reviving technique for collecting water for domestic uses and is generally used for non-hygienic purposes like watering gardens, flushing toilets, and washing clothes. In commercial premises like supermarkets it is used for things like toilet flushing where larger tank systems can be used collecting between 1000 and 7500 litres of water. It is claimed that in the South East of England there is less water available per person than in many Mediterranean countries. Rainwater is almost always collected strictly from the roof, then heavily filtered using either a filter attached to the down pipe, a fine basket filter or for more expensive systems like self-cleaning filters placed in an underground tank. UK homes using some form of rainwater harvesting system can reduce their mains water usage by 50% or more, although a 20-30% saving is more common. At the present time (depending upon where you live in the UK) mains water delivery and equivalent waste water and sewerage processing costs about £2 per cubic meter. Reducing mains-water metered volumes also reduces the sewerage and sewage disposal costs in the same proportion, because water company billing assumes that all water taken into the house is discharged into the sewers. (https://en.wikipedia.org/wiki/Rainwater_harvesting)

Uganda Rainwater harvesting has been used in Uganda to promote household and community scale water security for many years. Regular maintenance is an ongoing challenge with existing installation and there are many examples of installations that have failed due to poor maintenance. Research has also shown that awareness of RWH and how to access necessary resources to implement RWH is variable across Ugandan society. Thailand has the largest fraction of the population in

the rural area relying on rainwater harvesting (currently around 40%). Rainwater harvesting was promoted heavily by the government in the 1980s. In the 1990s, after government funding for the collection tanks ran out, the private sector stepped in and provided several million tanks to private households, many of which continue to be used. This is one of the largest examples of self-supply of water worldwide. In Bermuda, the law requires all new construction to include rainwater harvesting adequate for the residents. New Zealand has plentiful rainfall in the West and South, and rainwater harvesting is the normal practice in many rural areas, using roof water directed by spouting into covered, 1000 litre storage tanks, with the encouragement of most local councils. In Sri Lanka, rainwater harvesting has been a popular method of obtaining water for agriculture and for drinking purposes in rural homes. The legislation to promote rainwater harvesting was enacted through the Urban Development Authority (Amendment) Act, No. 36 of 2007. The Lanka Rainwater Harvesting Forum is leading Sri Lanka's initiative. (Wikipedia 2022)

The most valuable natural resource is water, but few people are aware of the limited freshwater availability, supply and importance especially in developing countries like India as well as countries endowed with lesser quantum of it. Groundwater is critical to India's water, food and livelihood security and supports more than 55% of our irrigation requirements, 85% of domestic requirements in rural areas and over 50% of requirements in urban and industrial uses.(MoWR 2010)

Rainwater harvesting is a common practice in the countries and areas where the annual precipitation is high and pure drinking and usable water is scarce. All over the world, economical condition has prompted the low-income groups to harvest the rainwater for household and essential uses. Several countries of the world in different regions have showed the popularity of this method. Originated almost 5000 years ago in Iraq, rainwater harvesting is practiced throughout the Middle East, the Indian subcontinent, Mexico, Africa, as well as in Australia and United States. Demand of water both from surface and underground sources continually increases with the increase in world population, leading to a consequence of crisis of water supply in different regions. Among other available alternative sources for water supply, rainwater harvesting has become the most economic solution for the water crisis.(Mohammad Abdullah Al Mamun January 2020)

Tamil Nadu government recognized the importance of rain water harvesting and made the rain water harvesting system mandatory by an act in 2002. The implementation of the rules and regulations and announcements under this act increased the awareness of the people on the importance of rain water harvesting. This has led to the provision of rain water harvesting structures being added in their houses. The rain water can be harvested to conserve and augment the storage of local groundwater and may also help improve the quality of ground water. The amount of water that can be effectively harvested is called water harvesting potential of the area. Rain water may be harvested by collecting rain water that falls on the terrace of the buildings and in the open spaces around the buildings. This collected water can be diverted to the existing open or bore wells with suitable arrangements. Rain water can also be collected in the open spaces around the building and may be recharged into the ground by having percolation pits dug in small houses, recharge trenches for big houses and apartments and recharge wells for large buildings and industries.

Chris Maxwell Gaines defines rainwater harvesting as "the accumulation and deposition of rainwater for reuse on-site, rather than allowing it to run off." While this definition is basic, the practice of rainwater harvesting is greatly varied from where the rainwater is collected from to how the rainwater is ultimately used. A more appropriate definition of rainwater harvesting might be the collection of rainwater from a surface that allows for the rainwater to be stored and used at a later time. In a typical rainwater harvesting situation, rainwater is collected from an impervious surface such as the roof of a building and then stored inside of a tank or cistern. Rainwater can be collected from other surfaces as well. Other surfaces include parking lots, roadways, driveways, and even land surfaces (once surface runoff from the land surface begins). (Chris Maxwell Gaines, February 10,2016)

"Water Harvesting is a critical issue in India given the existing scarcity and water quality problems experienced practically all over the country. The pattern of endowment of water resources and the long term predictions of deficits on per capita availability in different rainfall zones point to the need to create new resources" water harvesting and sustainable supply in India - R. N. Athavale, Centre for Environment Education.

"A Manual on Artificial Recharge of Ground Water", providing detailed guidelines on investigative techniques for selection of sites, planning and design of artificial recharge structures, monitoring and economic evaluation of artificial recharge schemes was brought out by Central Ground Water Board in 1994." - Manual on artificial recharge of ground water, (CGWA Sept- 2007).

The total amount of water available on Earth has been estimated at 1.4 billion cubic kilometres, enough to cover the planet with a layer of about 3 kilometres thickness. About 95 percent of the Earth's water is in the oceans, which is unfit for human consumption and other use because of its high salt content; about 4 percent is locked in the polar ice caps; and the remaining 1 percent constitutes all the fresh water in hydrological cycle including groundwater reserves. Only 0.1 percent is available as fresh water in rivers, lakes and streams, which is suitable for human consumption (Rao, 1998).

Mathur et al. was reported that more than 30% rain fall flows away either as surface or sub-surfaces losses reported in India as per average rain fall data in 1997. There is longitudinal and chronological difference in the rainfall. In India, more than 60% of agriculture sector was depends on monsoon rain fall, but non-linear behaviour of monsoon rises up the requirement of irrigation for agriculture productivity. Hence, irregular rain fall seasons leads to scarcity of water in every 3-4 years of pattern. It was observed sukha on every 3-4 years of cyclic pattern in semi-arid or arid region of India. Under such conditions RWH has significant demand to meet water requirement of world.

Conservation of rain water is mainly aim to increase agriculture productivity. However, preservation of rain water is justified only if proposed RWH system can store water for longer period of time. Suitable water resource management for naturally available and man made alternatives must be work out for different challenges to store water for longer time. Some of the issues like social economy, in efficient strategies, lack of awareness & technology and judicious management for water policies. India is progressing towards developed country with very good GDP growth. Rain fall distribution is such that large plain area of our country suffering from heavy flooding condition mainly on the bank of Ganga & Brahmputra. At the same time topical region of western India may have drought or drought like situations. In this situation, well

define water policies are require at central & state government level to balance hydro logical and the biological tasks of overall environmental eco - system. In this concern different concepts like linkages of perennial rivers of country associated with other water reservoir and tried to solve problems of flooded region along with dry land of nation. Alternative solution is to improve water storage capacity and efficiency of existing reservoir so stored water can utilized effectively during drought like situations (Mann and Ramana Rao 1981).

RWH management is one of acute strategic issue for monsoon based agriculture. The effectiveness of monsoon based agriculture production is mainly be influenced by on how competently soil moisture is preserved in-situ &/or extra runoff is gathered, stowed and used for supplementary irrigation system. India has a long history of RWH (rain water harvesting) with different constructions and arrangements constructed by the Administration or local organizations and accomplished by the public or village level organizations. Conversely, with technological expansion in pump, generator, electricity, manufacturing, irrigation technology, brings private share has extremely amplified and the tank systems were slowly discounted. Overall water storage system scenario now days are changed to individual storage system from community based systems and therefore it raises the possibilities of severs exploitation of ground water (Rockström, J. 2000).

With increase in awareness of RWH by keen efforts of individuals, NGOs and Government agencies There is now increasing interest to the low cost alternative generally referred to as ‘water harvesting’ especially for small scale farming systems. Indian society has knowledge and ideas for harvesting of rainwater since ancient times. step wells, Khet talavadi, tanka, open cannel system, monasteries and castles in India have constructed to store rainwater and utilized for different usages. Patan ni vav, Adalaj ni vav in North Gujarat region are good examples of the traditional rainwater harvesting systems. Apart from that concept of runoff farming and different methods to conserve soil moisture had been reviewed by researchers (Nega, 2004). Water scarcity and water quality problems are of particular concern in the tropical regions of the world where many countries are less developed Nelly (2010).

The techniques like Rain Water Harvesting (RWH) and Artificial Recharge (AR) to groundwater are useful tool in water management as it directly benefits the society by solving the water problem of present and future generation to some extent. Rain water is a major source of fresh water and the activity of collecting rainwater directly for beneficial use or recharging it into the ground to improve groundwater storage in the aquifer is known as rain water harvesting. Rain water harvesting has been done from the days of ancient civilizations in India and have had improvised methods with locally available materials (Agarwal and Narain, 2005).

Rain water harvesting is easy to apprehend from its name itself or reversing the same i.e. "harvesting rain water" clarifies it further. In urban areas it can be done by collection of rain water from surfaces such as rooftops, the storage and distribution of rain water can be done for indoor or outdoor use. Rain water harvesting is a simple and one of the oldest methods of conserving water and is also economical, safe and sustainable water resource. In urban environment, the storage and direct consumption of the rain water is problematic mainly because of the limitations associated with its storage and maintenance. In such areas, the quality of rain water is expected to be of poor and may even contain physico-chemical and biological pollutants mixed from the surroundings. Rooftop catchment of rainwater can provide good quality water, clean enough for drinking, as long as the rooftop is clean, impervious, and made from non-toxic materials (Wirojanagud et al., 1989).

Generally, during rainy seasons, in absence of RWH structures the rainwater flows down in the form of run-off or storm water drainage without benefiting the area where rainfall has occurred. RWH plays a major role in managing the temporary water crisis and it also augments the aquifers, especially in urban areas. Adopting and practicing RWH at the national level is needed for sustainable development of water resources. Rain water harvesting methods have gained a significant importance and many government and non- governmental agencies have prepared and issued guidelines for popularizing rain water harvesting in our country (CGWB, 2007).

'Water History' is a part of environmental history whose task is the study of human relationships through time with the natural communities of which they were a part, in order to explain the processes of change that affects relationship. As a method, environmental history is the use of ecological analysis as a means of understanding

human history. It studies the mutual effect that other species, natural forces and cycles have on humans and the actions of humans that affects the web of connections with non-human organism and entities. Historians began to use the term 'Environmental History' sometimes in the very late 1960s or early 1970s. The popular ecology movement of the late 1960s and 1970s was decisive or influential in the emergence of environmental history as a self conscious genre in Europe and North America and the environmental struggle in India, China, and Latin America drove some scholars to fold environmental perspectives into their works.

Rain Water Harvesting is the technique of collection and storage of rain water at surface or in sub-surface aquifers before it is lost as surface run-off. The harvested resource can be utilized at the time of need. Artificial recharge to groundwater is a process by which the groundwater reservoir is augmented at a higher rate than under natural conditions of replenishment. Methods of groundwater recharge mainly in urban areas are roof top rain water, storm runoff harvesting through recharge pit, recharge trench, recharge shaft and recharge well whereas in rural areas, techniques of gully plug, contour bund, percolation pond, check dam, nalla bund, recharge shaft, dug well recharge and subsurface dyke are used.

The Environmental Protection Act, 1986 was the prime act, which was controlling the Development and Management of Water in India. Later on in 1997, Environment impact assessment notification and pollution control and prevention act, the various conservation Act, 1980 provides, the compensatory forestation, pollution control and impact of withdrawal of water in the country. The National Water Policy gives utmost priority for drinking water through its National Water Policy 2002. At the same time, International Conference on Water Security Stresses that common man should have access to safe and sufficient water & sanitation which are the basic human needs to be attended by the any Government. If it is not protected by law, it will result in excess Environmental hazards, scarcity of water and unequal distribution of water, unplanned utilization of water. However understanding of geological set up and behaviour of ground water level has major role in selecting the areas feasible for rainwater harvesting. Disposition of geological strata below the ground surface is 55 understood to estimate the underground storage space availability. The deeper water level indicates the higher scope of rainwater harvesting for artificial recharge to ground water. Occurrence of very deep ground water levels suggests to use bore wells/tube

wells as recharge structures instead of dug well. The small catchment is preferred for rainwater harvesting so as to have a better control in maintaining the cleanliness. The roof top rainwater is comparatively pure and clean and requires nominal filtration.

Central Ground Water Board (CGWB), under the Ministry of Water Resources is the National Apex Agency for investigations, evaluation and management of ground water resources. It was created in 1972 by the amalgamation of Exploratory Tube wells Organization and ground water wing from Geological Survey of India. The Board has its headquarters at Faridabad, Haryana. The mandate of CGWB is to "Develop and disseminate technologies and monitor and implement national policies for the Scientific and Sustainable development and management of India's Ground Water Resources, including exploration, assessment, conservation, augmentation protection from pollution, and distribution based on principles of economic and ecological efficiency and equity." Central Ground Water Authority has been constituted under Section 3 (3) of the Environment (Protection) Act, 1986 vide notification no. S.O. 38 (E) dated 14.1.97 and subsequent amendments for the purposes of regulation and control of ground water development and management. Majority of the farmers belonged to large farmers category in case of with RWHS(63.33%) and without rain water harvesting system (46.67%) followed by small farmers. The average land holdings observed was almost same (2.54 ha and 2.02 ha) in both areas. The difference in the land holding of the farmers of both adopters and non-adopters group was found not significant. The land holdings of the farmers before and after adoption of rain water harvesting system were compared an the difference in land holding was found highly significant (1%). This indicates that the area of cropping or the increase in yield in case of either of the group is due to impact of RWHS not because of land holdings or the farmers brought more area under cultivation after adopting the Rain water harvesting system because of the availability of moisture even in the rabbi season.

Objectives of the study

i) To know the Socio-economic background of the Respondents.

ii) To Identify the Techniques used for Rain Water Harvesting.

iii) To assess the different Technologies Implemented for Rain Water Harvesting.

iv) To analyses the Water Management Resource and Preservation Methods.

v) To analyses the Benefits and Usage of Rain Water Harvesting.

vi) Assessment of Quantity of Rainwater Harvested in numbers of underground Storage tanks.

2. REVIEW OF LITERATURE

The review of literature pertaining to a study on "Rain Water Harvesting and Water Resource Management" in selected villages of Tirupur district is discussed under the following headings.

- Benefits of Rain Water Harvesting.
- Usage of Harvested Rain Water.
- Learning about Techniques and Technologies Implemented for Rain Water Harvesting and Water Resource Management.
- Related Studies.

"These will lead to high rate of consumption of most valuable natural resource Water resulting in augmentation of pressures on the permitted freshwater resources. Ancient method of damming river and transporting water to urban area has its own issues of eternal troubles of social and political. In order to conserve and meet our daily demand of water requirement, we need to think for alternative cost effective and relatively easier technological methods of conserving water. Rain water harvesting is one of the best methods fulfilling those requirements. The technical aspects of this paper are rainwater harvesting collected from rooftop which is considered to be catchment areas from all hostels and Institutes departmental building at N.I.T. Rourkela Campus. Gutter design, its analysis, first flush and filtration mechanism are also dealt with in detail." Rainwater Harvesting at (N.I.T. Rurkela, By – Ranjit Kumar Sharma , Department of civil engineering- 2010).

The issues and constraints associated with the "water resource management" in the Tungabhadra River basin in India. Of course, the study is limited to the state of Karnataka. Tungabhadra river is the combination of two rivers Tunga and Bhadra. Tungabhadra is not a perennial river. The water of Tungabhadra is used for drinking, agriculture, industry and domestic use. But, the authors have pointed out the problem of climatic changes and the lack of coordination among the fourteen departments concerning Tungabhadra in the water management of the river. They have discussed lot of issues like inter-state water dispute, unauthorized irrigation, crop violation, head reach and tail enders problems at the agriculture level. They also discuss evaporation and transpiration of the Tungabhadra project.(Umesh et.al., 2013)

The study has succeeded in discussing the various challenges of water resource management in India. He argues that the agriculture being the largest consumer of water, this sector needs a special attention. Technological choices, participatory governance and proper pricing are suggested as measures to improve water management in agriculture. He explains the inter-dependence between different sectors and cross-cutting problems. The author feels that the demand for water is reaching a crisis proportion due to multifarious reasons, namely, increasing population, increasing demand for food production, industrialization, urbanization and shifting rainfall patterns. He advocates for a comprehensive national water policy which could benefit not only the stake holders inside the country but also the neighboring countries. (Suresh 2012)

In the study, "water resource management policy in India" has to take into account the economic viability, the global climatic changes, flood management, equitable distribution of water to the poor, meeting the varied requirements of the community, rising sea level, situation of draught etc. The author has recommended a soft path instead of a hard path in India because of its socio, economic, cultural and geographic diversity in order to achieve a sustainable development. (Sharad 2012)

"As an alternative paradigm for more sustainable water availability harvesting rainwater, storing it in tanks, and recharging groundwater may be put in place. On the civil society becoming more aware and sensitized regarding its potential, rainwater harvesting can perhaps be scaled up to neighborhood and micro-watershed levels. Armed with complete information, it has been seen that people naturally would have a tendency to conserve their own resources." Measures for Ensuring Sustainability of Rainwater Harvesting By Prepared by Water for Asian Cities Programme, India - unhabited & (Directorate of Urban Administration & Development Government of Madhya Pradesh-2010).

"The paper seeks to address the issue of rainwater harvesting for houses, apartments, industries and institutions especially in an urban context. It does not specifically exclude peri-urban and semi rural area as land use restriction in many cities push industries to peripheries and fringes." Rainwater harvesting in urban areas- industries By – (S.Vishwnath, Bangalore2012).

The paper discuss the physical—hydrological and meteorological— and socioeconomic and purely economic considerations that need to be involved in decision - making with regard to water harvesting investments or analyzing the impact of RWH

systems, and how these considerations limit the scope of water harvesting; and make practical suggestions for improving the effectiveness of rainwater harvesting.-Rainwater Harvesting in the Water- scarce Regions of India: Potential and Pitfalls By- (Mr. Dinesh Kumar, Ankit Patel1 and O.P. Singh IWMI-TATA Water Policy Program, Hyderabad, India, Benaras Hindu University, Varenasi, India,2012).

"These will lead to high rate of consumption of most valuable natural resource Water resulting in augmentation of pressures on the permitted freshwater resources. Ancient method of damming river and transporting water to urban area has its own issues of eternal troubles of social and political. In order to conserve and meet our daily demand of water requirement, we need to think for alternative cost effective and relatively easier technological methods of conserving water. Rain water harvesting is one of the best methods fulfilling those requirements. The technical aspects of this paper are rainwater harvesting collected from rooftop which is considered to be catchment areas from all hostels and Institutes departmental building at N.I.T. Rourkela Campus. Gutter design, its analysis, first flush and filtration mechanism are also dealt with in detail." Rainwater Harvesting at N.I.T. Rurkela, By – Ranjit Kumar Sharma , Department of civil engineering- 2010.

Rainwater Harvesting Typologies for UK houses and a set of criteria were defined that enabled RWH system configurations to be evaluated using multi criteria analysis (MCA). The evaluation criteria were defined as follows: reduce capital costs, maximise water saving efficiency, minimise operational energy consumption associated with water supply, minimise peak storm-water discharges, and minimise annual storm-water discharges. Based on these results, it was suggested that minor alterations to existing RWH technologies, such as integration with real time storm-water control devices, could see demand for RWH systems grow in the years ahead. (Melville-Shreeve et al. 2016)

To evaluate rainwater harvesting technologies and the factors contributing to adoption of the technologies in the ASAL areas with Makueni County being the case study, within Kenya‟ s Eastern Region. The data was analyzed using Statistical Package for Social Scientists (SPSS). A logistic regression analysis was conducted to predict factors affecting adoption of Rain Water Harvesting Technologies „ s within 160 households in Makueni County. Some of the factors found to have statistically significant positive effect on the adoption of Rain Water Harvesting Technologies were gender, literacy levels, social and

economic status and technological know how on Rain Water Harvesting Technologies. (Kimani et al. 2015)

As per the study on Rainwater Harvesting practices being practiced in Ethopia, which had been highly dependent on rainfall , as rainfall controls the crop yields in semi-arid regions. To manage the irrigation system, Government and the local community practiced different water harvesting techniques. The in-situ and ex-situ rainwater harvesting techniques had shown significant impact on improved soil moisture, runoff and groundwater recharge; and increased agricultural production, which in turn reduced the risks and delivered positive impacts on other ecosystems. Their study also clarified that rain water harvesting had a potential of addressing spatial and temporal water scarcity for domestic consumption, agricultural development and overall water resources management. (Yosef and Asmamaw 2015)

To evaluated the dual "Benefits of rainwater harvesting systems" by using a model that simulates a single RWH system in Richmond, Virginia, using storage volume, roof area, irrigated area, an indoor non potable demand, and a storage dewatering goal as independent design variables. A reliability function was fit to the simulation results, and a solution method was developed to solve for an unknown variable as a function of the others. This method evaluated different design cases that provide the same water supply and/or runoff reliability, demonstrating that the design variables could be substituted for each other, using care to restrict substitutions between functional inputs or (separately) functional outputs. Results indicated that land uses that provide larger demands, such as offices, commercial sites, and high-density residential sites, may be better suited than lower-density residential lots where RWH is more commonly employed. (Sample et al. 2013)

As per the study for estimating the potential of rainwater harvesting as a supplementary source of water supply in Kanai (Mali) district of Zangon-kataf, the local government area of Kaduna State, Nigeria. Results indicated that greater proportion of the respondents (60%) made use of about 100-200l of water in their respective households per day and it has been observed that inspite of having sufficient rainwater, the mean annual rainfall of the area studied was 1,064 mm, they could not meet the need of rural community. Therefore, recommendations were made to upgrade the existing rain water harvesting system involving the participation of villagers. (Lekwot et al. 2012)

Bazza (1994) stated that, the first water harvesting systems were installed between 4000 and 2500 BC, their remnants were discovered in Iraq and the Arabian Peninsula, along the routes used at the time by caravans. Portuguese of Moroccan coastal cities on the Atlanta Ocean in the 16th century, built large cisterns for storing enough rainwater to assure an autonomous supply to the cities throughout the dry periods.

Investigations have also been reported from the Chennai city by various authors, on different aspects of the quality of surface and groundwater. A perusal of these studies helped in planning the present study and design of the field sampling program. A brief account of the available studies is reviewed here.The Centre for Science and Environment maintains very useful information on the rainwater harvesting in India and reports of results of investigations done in various cities (CSE 2008) and also provides guidelines for individuals/ organizations to implement successfully the rain water harvesting program. An account on the groundwater status of the Chennai city and its hydro geological environment is available here. The Centre for Science and Environment maintains very useful information on the rainwater harvesting in India and reports of results of investigations done in various cities (CSE 2008) and also provides guidelines for individuals/organizations to implement successfully the rain water harvesting program. An account on the groundwater status of the Chennai city and its hydro geological environment is available here.

"An Analysis of Demand and Supply of Water in India" gives an interesting data analysis with regard to the availability of fresh water in the world and also in India. He expresses his concern over the increasing demand for water in domestic, agricultural and industrial sectors in India. Therefore he argues for a sustainable and economically viable water policy which can encompass the optimum utilization of the existing water and reducing the water consumption in agriculture by improved technology. Conserving and preserving the water bodies, rain water harvesting, ground water recharging etc. are the present need of the Asian continent in general and India in particular. (Tariq Ahmad Bhat ,2014)

The study has succeeded in clearly explaining the paradigm shift in the water resource management in the twelfth plan. The strategy could reflect inclusiveness because of the participation of the stake holders of water from the different streams in the society. (Mihir Shah 2013)

In Hegde paper focuses on water scarcity and food security in India. The distribution of rainfall in the country is satisfactory over the years. But, due to the lack of efforts on the part of the governmental and non-governmental agencies to create proper awareness, the rain water has not been properly harvested. The author also points towards the problem of poor infrastructure and lack of funds to construct dams and reservoirs. The net result is scarcity of water for drinking, food production, live stock husbandry and industry. The excessive use of chemical fertilizers has increased the use of water. The use of pesticides has polluted water. The author suggests plenty of measures for motivating the users for the judicious use of water and participating in the water conservation movement. He also appeals the general public to change their lifestyles, so that, we can solve the problem of water scarcity and ensure food security in India. (Hegde 2012)

The study shows the "Water Efficient Technologies for Irrigated Commands" discuss the various aspects of water. The importance of water as 'life giver' in this planet has been stressed by the authors. The surface water resources with a total water potential of 187.9millian hectares, ground water resources with its spatial and temporal distribution, conflicting objectives of water resource development programmes, increasing sectoral competition between sectors, pollution of surface and ground water resources, crop productivity, various techniques of irrigation, paradox of rising and falling water tables, water conflicts, re-usage of drainage water, up gradation of technology, strategies to enhance the efficiency in water use are the areas on which the authors have clearly thrown light. The paper stresses the need for a better water resource management policy for the sustainable development of the economy and the very existence of our planet. (Hanchinal et.al.,2012)

The study expose a pertinent problem related to water in India, with capacity building in water resource sector. The authors feel that to cope up with the increasing demand for water in India, the institutional arrangements, the water policy and human resources are inadequate. They argue that there is an urgent need to increase the capacity building in the water sector. Otherwise, the already existing water scarcity situation may worsen and may reach an unmanageable proportion. (Dinesh et.al.,2012)

With the help of a case study conducted at the Nelamangala watershed area in Karnataka, clearly shows the ground water recharging possibilities. The author has used Soil and Water Assessment Tool (SWAT) in ARCVIEW GIS for the study. The water evaporation and water precipitation rates are calculated in the study area and found out that

the surface run off of rain water is directly proportional to precipitation. So, the author comes to the conclusion that in order to recharge the ground water, ground water recharge structures are better than surface water storage structures. Thus the micro watershed model of T.Begur watershed to recharge tube-wells is definitely an encouraging finding in improving the water table. (Anshuman 2011)

In their paper present the paradox of plenty and scarcity of water. The availability of the ground water in different parts of the country, in certain areas irrational digging of tube-wells has resulted in the depletion of ground water. Whereas in certain other areas, especially in canal command areas soil salinity is a great problem due to the gradual rise in ground water levels. Therefore the authors say that there can be no single ready made solution to the water resource management in the country. (Jha and Sinha 2010)

In their book "Water Resources Systems and Management", have presented the issues related to water resources in highly educative manner. They have thrown light on the scope of using surface water in India as only 16 per cent of the surface water has been utilized out of about 1683 X 109m of the total surface water available in India. They have also discussed in detail the importance of water due to increased industrialization, agriculture, generation of hydro-power, water transport, recreation and very importantly potable water to the increasing population. They are optimistic with regard to the advancement in scientific and technical knowledge in the field of flood management, sewage water treatment, ground water management, rain water harvesting etc., to solve the problem of water scarcity. The authors have stressed the need for meticulous planning and responsible management with regard to water resources. They are of the opinion that the present fear of water scarcity is actually man made, so, if the human efforts are harnessed in harmony with the nature, the water problem can be solved in the near future. (Gupta and Amit Gupta 2010)

The study on Roof Top Rain Water Harvesting feasibility in the premises of zilla parishad primary school at village Ranwahi, Kurkheda taluka, Gadchiroli District Maharashtra. The main objectives of the scheme is The purpose of the scheme is to tap, store and conserve rain water so as to utilize the same during the lean period. The project, when established in the premises of Zilla Parishad Primary School, will also help in bringing awareness among the students and villagers regarding conservation of rainwater. There are 28 students in the school. The total roof top area of the school is around 1500 sq. feet. It is estimated that around 1723 M3 of rainwater can be harvested annually and can be use in

summer.The roof of the Zilla Parishad, Primary School is 1500 sq. feet which is being used for harvesting the rainwater during the rainy period. The rain water is stored in the cement concrete tank constructed over the ground by the side of the school building 82 within the premises. The stored rainwater would be utilized by the school children and staff in two toilets. The water would be stored safely as the storage tank is covered properly. The inlet/ outlet etc. are provided for the use and cleaning purpose etc. The actual withdrawal of water is done by the children through the taps only in lean season. (S.K. Jain, Scientist ' D', Sunil Toppo, Assistant Hydro geologist and Bhoosan Lamsoge, Scientist'B'-2011)

Components of Rain Water Harvesting

Rooftop collection systems are common, taking advantage of drainage and gutter systems. Metal roofs are ideal for rainwater collection. They are easy to keep clean and maintain a high level of rainwater quality. Some roof materials, such as asphalt, may limit water uses to non-potable ones.

Conveyance systems via gutters, channels, and pipe systems are used to carry collected water to storage and areas of use. Storage systems keep collected rainwater for later use. These are typically tanks, either on the surface or below ground. Open ponds may also be used, particularly for decorative effect.

Treatment will be required for most potable uses and possibly for some non-potable uses. Treatment typically includes filtration to remove particulate matter in the collection and conveyance of the rainwater. Simple disinfection (chlorination, ultraviolet - UV, solar) may be required to control microbial growth in various systems, including storage systems.

Distribution of water stored to its intended use may require a system of pumps, pipes, and controls.

Collection and use of rainwater

Rainwater collection systems are typically designed to be gravity fed.Storage areas are typically lower elevation, so a pumping system is generally required for intended reuse. Since collected rainwater is generally used close to its capture, the energy needed to convey the water tends to be minimal. Compared to conveyance from other supplied sources of water (groundwater, conveyed surface water, shipped water), rainwater harvesting would likely have lower energy costs.

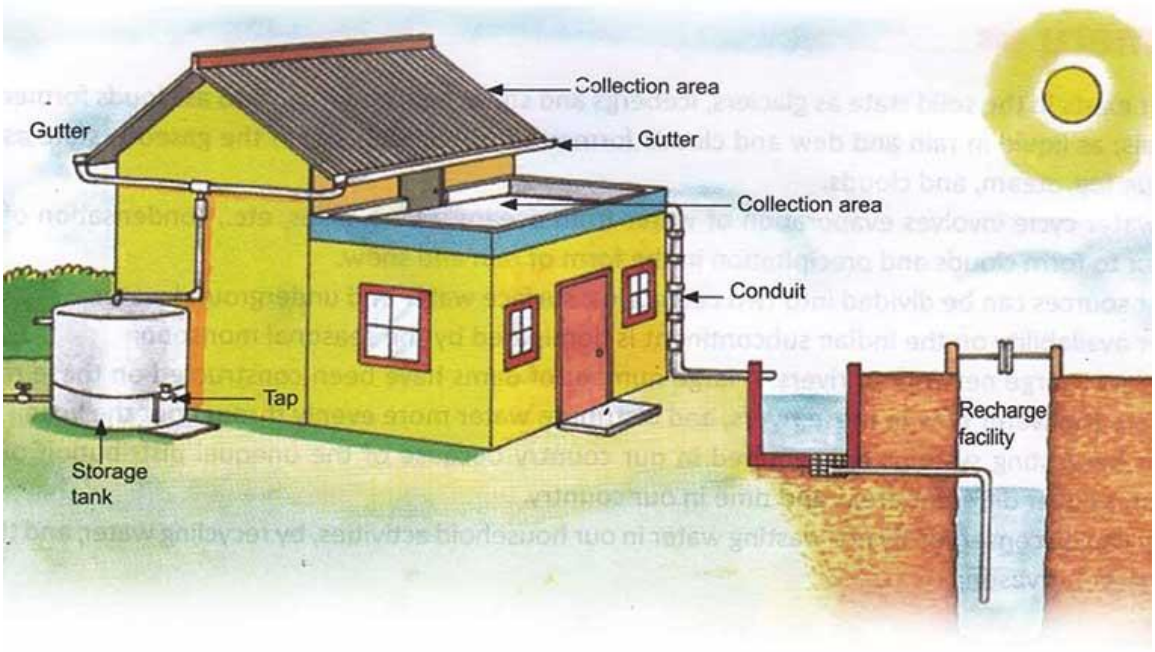
Maintenance

Systems are simple and tend to be robust. Monitoring and maintenance require additional effort. This includes maintenance of roofs used as collection areas, cleaning of gutters, maintenance of storage tanks and vaults, pumps and maintenance of water treatment systems (when installed).

Methods of Rain Water Harvesting

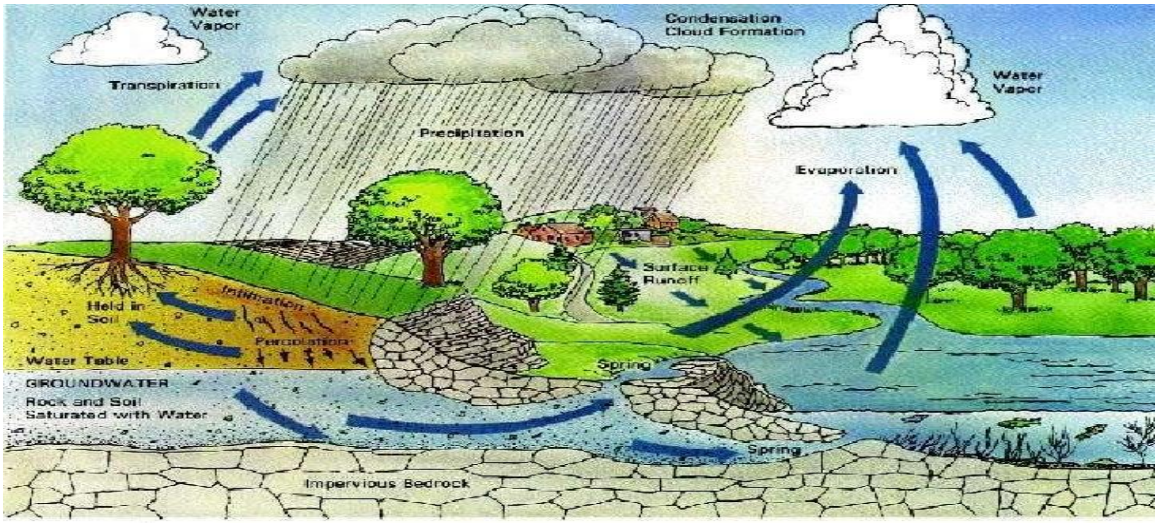
Rooftop rainwater harvesting

Rooftop Rain Water Harvesting is the technique through which rain water is captured from the roof catchments and stored in reservoirs. Harvested rain water can be stored in sub-surface ground water reservoir by adopting artificial recharge techniques to meet the household needs through storage in tanks.



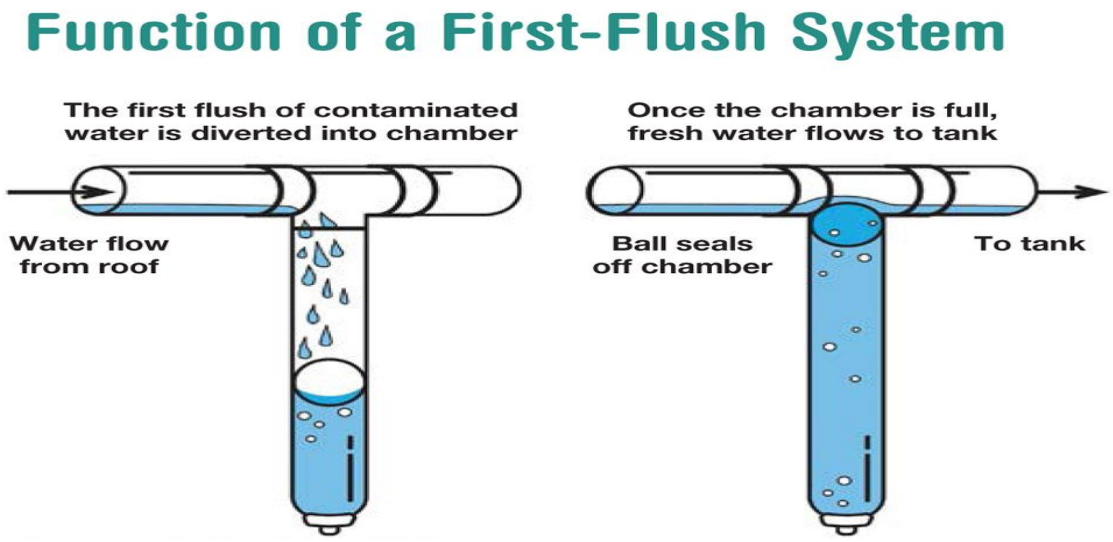
Surface runoff harvesting

Surface Runoff Water Harvesting is commonly used in urban areas. It can be defined as the method of collection, accumulation, treatment, and storage of the runoff water for immediate and future use. Most commonly the collected water is used for the recharging of subsurface aquifers.



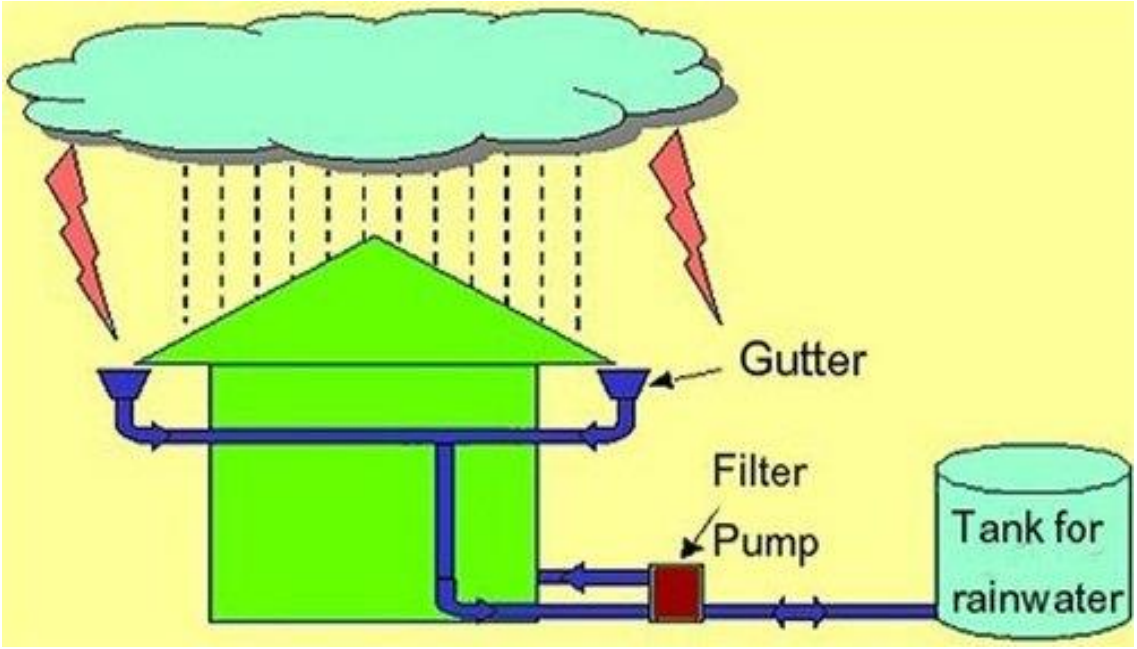
First-Flush Rain Water Harvesting

The first pass of water in any storm essentially washes your roof of all the sediments that have collected since the last rain. The idea is that diverting the first flush can help ensure cleaner water in your rain tanks or barrels.



Transportation

Transportation Rainwater from the rooftop has to be carried down to the storage or harvesting system through water pipes or drains. Water pipes should be of required capacity, which are UV resistant. Water from roofs can be collected through gutters and stored in harvesting tanks through pipes.



Catchment

The catchment of a water harvesting system is the surface which directly receives the rainfall and provides water to the system. It can be a paved area like a terrace or courtyard of a building, or an unpaved area like a lawn or open ground. A roof made of reinforced cement concrete (RCC), galvanized iron or corrugated sheets can also be used for water harvesting.

Filter

These are the basics of rainwater harvesting pre-filtration. Removing sediment is the top priority to rainwater harvesting as it improves the quality of water while reducing the amount of maintenance of other components. This very simple step can save lots of headaches and improve the quality of water that you are collecting.

Objective of Rain Water Harvesting

- To overcome the inadequacy of surface water to meet our demands.
- To arrest decline in ground water levels.
- To enhance availability of ground water at specific place and time and utilize rain water for sustainable development.
- To store the water on surface or underground.

Purposes of Rain Water Harvesting

- Two Major Purposes - Agricultural and human consumption.
- Freshwater augmentation technology.
- Increase groundwater recharge.
- Reduce storm water discharges, urban floods and overloading of sewage treatment plants.

Advantages of Rain Water Harvesting

- ✓ Less cost.
- ✓ Helps in reducing the water bill.
- ✓ Decreases the demand for water.
- ✓ Reduces the need for imported water.
- ✓ Promotes both water and energy conservation.
- ✓ Improves the quality and quantity of groundwater.
- ✓ Does not require a filtration system for landscape irrigation.
- ✓ This technology is relatively simple, easy to install and operate.
- ✓ It reduces soil erosion, storm water runoff, flooding, and pollution of surface water with fertilizers, pesticides, metals and other sediments.
- ✓ It is an excellent source of water for landscape irrigation with no chemicals and dissolved salts and free from all minerals.

Rain Water Harvesting Methodologies

- Capturing runoff from rooftops – Roof water harvest.
- Capturing runoff from local catchments – Land harvest.
- Capturing seasonal floodwaters from local streams.
- Conserving water through watershed management.

For Urban & Industrial Environment

- Roof & Land based Rain water Harvesting
- Public, Private, Office & Industrial buildings
- Pavements, Lawns, Gardens & other open spaces

3. METHODOLOGY

Research Methodology is the specific procedures or techniques used for the identify, select, process and analyse information about a topic. It specifies the frame work of research design, sampling procedure, methods of collection and analysis of data. In this Chapter the methodology pertaining to the study on the **Rain Water Harvesting and Water Resource Management** comprises of the following steps:

3.1 Locale of the Study

3.2 Selection of the Sample

3.3 Selection of the Method

3.4 Construction of tools

3.5 Obtaining Ethical Clearance of the Study

3.6 Collection of the data

3.7 Analysis and Interpretation of the Data

3.1 Locale of the Study

The area selected for the study is selected villages of Tirupur District. Tirupur District is one of the 38 districts of the Indian state of Tamil Nadu, formed in 22 February 2009. Dharapuram was the largest taluk by area in the district. The district is well-developed and industrialized. The Tirupur banian industry, the cotton market, Kangeyam bull and Uthukkuli butter, among other things, provide for a vibrant economy. The city of Tiruppur is the administrative headquarters for the district. As of 2011, the district had a population of 2,479,052 with a sex-ratio of 989 females for every 1,000 males. According to 2011 census, Tirupur had a population of 444,352 with a sex-ratio of 955 females for every 1,000 males, much above the national average of 929. A total of 48,802 were under the age of six, constituting 24,818 males and 23,984 females. Scheduled Castes and Scheduled Tribes accounted for 5.47 percent and 0.06 percent of the population respectively. The average literacy of the city was 78.17 percent, compared to the national average of 72.99 percent . The city had a total of 124,617 households. There were a total of 207,358 workers,

comprising 490 cultivators, 721 main agricultural labourers, 3,492 in house hold industries, 191,882 other workers, 10,773 marginal workers, 89 marginal cultivators, 74 marginal agricultural labourers, 470 marginal workers in household industries and 10,140 other marginal workers. The area of Tirupur was expanded in 2011 and the population was 877,778 as per the revised estimate.

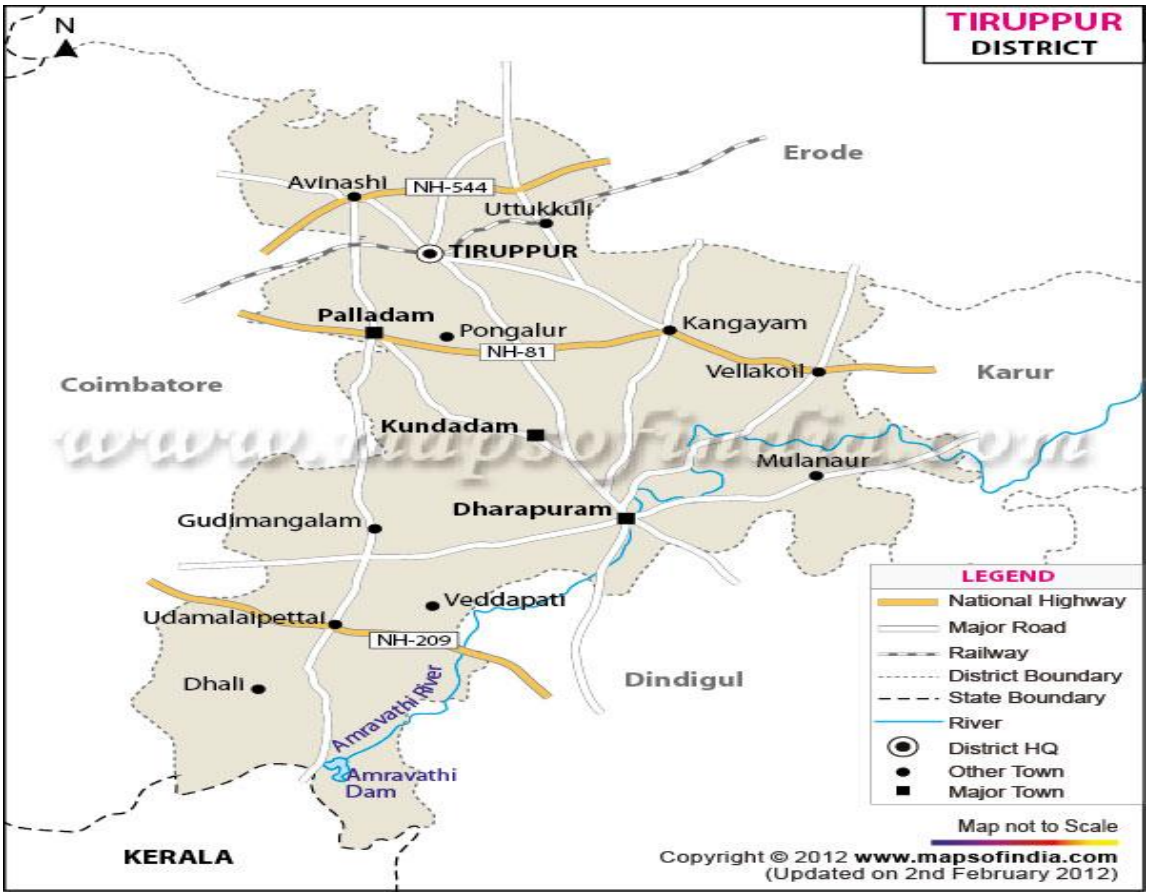


Figure 3.1.1

Tirupur District Map

The majority of the study was taken from varapalayam village of Dharapuram block from Tirupur district. Varapalayam is a small Village/hamlet in Dharapuram block in Tirupur District of Tamil Nadu State, India. It comes under Varapalayam panchayat. It is located 56 KM towards south from District head quarters Tirupur. 461 KM from state capital Chennai. Varapalayam is surrounded by Thoppampatti block towards South , Kundadam Block towards North , Mulanur Block towards east , Madathukulam block towards West Palani ,

Vellakoil , Udumalaipettai , Oddanchatram are the near by cities to Varapalayam.This place is in the border of the Tirupur district and Dindigul district. Dindigul District Thoppampatti is south towards this place .Varapalayam is a large village located in Dharapuram Taluk of Tirupur district, Tamil Nadu with total 787 families residing. The Varapalayam village has population of 2481 of which 1227 are males while 1254 are females as per Population Census 2011.

In Varapalayam village population of children with age 0-6 years is 173 which makes up 6.97 percent of total population of village. Average Sex Ratio of Varapalayam village is 1022 which is higher than Tamil Nadu state average of 996. Child Sex Ratio for the Varapalayam as per census is 966, higher than Tamil Nadu average of 943.

3.2 Selection of the Sample

A sample is a finite part of statistical population whose properties are studied to gain information about the whole (Webster,2014). A Sample is a subset of population units. Sampling is the simple process of learning about the population on the basis of a sample drawn from it (Gupta, 2014). a sample is the part of universe which we select for the purpose of investigation.

Random sampling is one where each items in the universe has an equal chance of known opportunity of being selected. A random sample is a sample selected in such a way that every item in the population has an equal chance to being selected (Pillai et al ,2012).

Sample selected for the study was 70 samples from the selected villages of Tirupur district. A sample of 70 respondents who are benefited through rain water harvesting were selected randomly for the study from the villages of Varapalayam, Nanjiyampalayam, Kupuchipalayam, Thoppampatti, Venkikalpalayam, Velankattuputhur, Kupunankovil, Sagunipalayam, Kanchipuram, Mangalampalayam, Manakadavu, Kattampatti.

3.3 Selection of the Method

The present study is based on primary data. The primary data is the data collected from original source from which the researcher directly collects data that have not been previously collected. Primary data were collected through personal interviews with the

selected respondents. Primary data are those which are collected afresh and for the first time and thus happen to be originally in character. Secondary data is the data which are not originally collected but rather obtained from published or unpublished sources. Secondary data were collected from books, journals, periodicals and website sources.

3.4 Construction of Tool

Interview method was the method used for conducting the study. Interview method is one of the powerful tools to collect information in social research. The interview techniques is a verbal method of securing data especially in the field research connected with social problems. It is a direct method of enquiry (smriti chand,2013). Interview schedule is a written list of questions, in any language in open or closed ended prepared for the investigator in a face to face interaction. A list of questions relating to the proposed study is prepared and the answers for the questions are obtained from the respondents (Umar farooq.2012). The investigator prepared a detailed Interview schedule including personal details and various study related questions and extent of utilization of those measures are provided.(Annexure-I)

3.5 Obtaining Ethical Clearance of the Study

The application form explaining the design and the protocols used in the research study was subjected to the institutional human ethics committee and the ethical clearance was obtained.(Annexure-II)

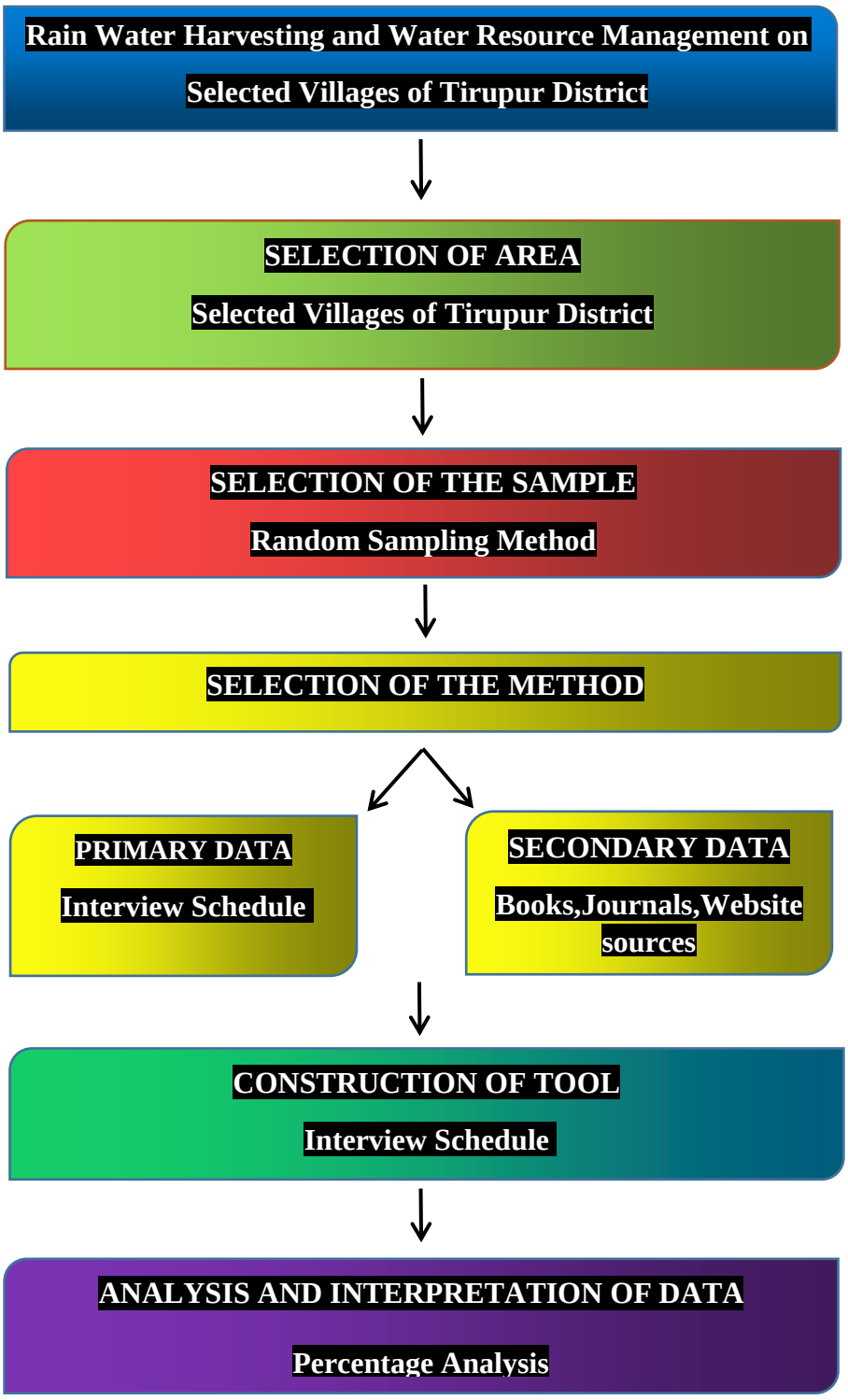
3.6 Collection of the data

The study was conducted by utilizing the tools prepared by personally contacting the selected respondents who are benefited by implementing rain water harvesting system. The respondents are actively participated and co-operated for the data collection process. The duration for the collection of data was 25 days.

3.7Analysis and Interpretation of the Data

After creating a rapport with the respondent, the data collected were consolidated, tabulated analyzed and interpretation was drawn as percentage analysis was done and are presented in chapter 4.

METHODODLGY



4. RESULT AND DISCUSSION

The result pertaining to the study on "Rain Water Harvesting and Water Resource Management" were discussed in the following headings.

4.1 Socio Economic Profile of the Respondents

4.2 Rain Water Harvesting System

4.3 Government Scheme for Rain Water Harvesting

4.4 Technologies implemented for Rain Water Harvesting and Water Resource Management

4.5 Source and Benefits of Rain Water Harvesting

4.6 Improvement of Ground Water Level Through Rain Water Harvesting and Water Resource Management

4.1 Socio Economic Profile of the Respondents

Socioeconomic status is an economic and sociological combined total measure of a person's work experience and of an individual's or family's economic access to resources and social position in relation to others. Socio economic profile of the respondents are depicted in Table - 4.1.1.

TABLE 4.1.1

SOCIO ECONOMIC PROFILE OF THE RESPONDENTS

Socio Economic Factors	Aspects	Frequency (n = 70)	Percentage of the Respondents
Age (Years)	20-30	3	4
	31-40	32	46
	41-50	28	40
	Above 50	7	10
Gender	Male	20	29
	Female	50	71
Educational qualification	Secondary	25	36
	Higher secondary	15	21
	Graduate	25	36
	Post Graduate	5	7
Area of locality	Rural area	48	69
	Urban area	22	31
Income level of the beneficiary per annum(Rs.)	50000 – 100000	15	21
	100001- 150000	20	29

	Above 200000	35	50
Income level of the family per annum(Rs.)	200000 – 400000	15	21
	400000 – 600000	20	29
	Above 600000	35	50
Occupation	Agriculture	43	61
	Daily wages	12	17
	Self- employment	5	7
	Others	10	14

Age

Age as a factor, determines the vitality of the organizational ability and the attitude and their interest and response towards any challenging activity. The age profile of the selected respondents revealed that 46 percent of the respondents were between the age group of 31-40 years, 40 percent of the respondents were between the age group of above 41-50 years, 10 percent of the respondents were in the category of above 50 years and only 4 percent of the response were belongs to age group of above 20-30 years.

Gender

Gender is the range of characteristics differentiating between masculinity and feminity. Majority of 71 percent of the respondents were female and only 29 percent of the respondents were male.

Educational qualification

Education is an important element in human resource development . The present study also highlights the educational qualification of the respondents, there is an equal percent of response from secondary and graduates of 36 percentage, 21 percent of the respondents completed higher secondary education and only 7 percent of the respondents were studied upto post graduates.

Income level of the respondents per annum

The study also gives the information about the income level of the respondents per annum that is , 50 percent of the respondents were earning above Rs.150000 per annum , 29 percent of the response were earning upto Rs.100000 to Rs.150000 , and only 21 percent of the respondents were earning upto Rs.50000 to Rs.100000.

Income level of the family per annum

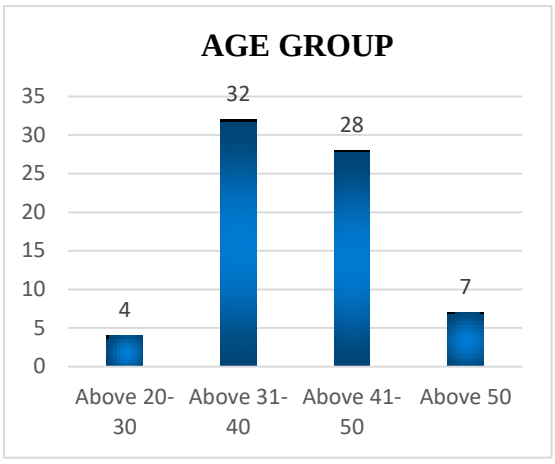
Among the selected respondents, 50 percent of the family were earning above Rs. 600000. About 29 percent of the family were earning upto Rs.400000 to Rs. 600000 and only 21 percent of the family were earning upto Rs.200000 to Rs. 400000.

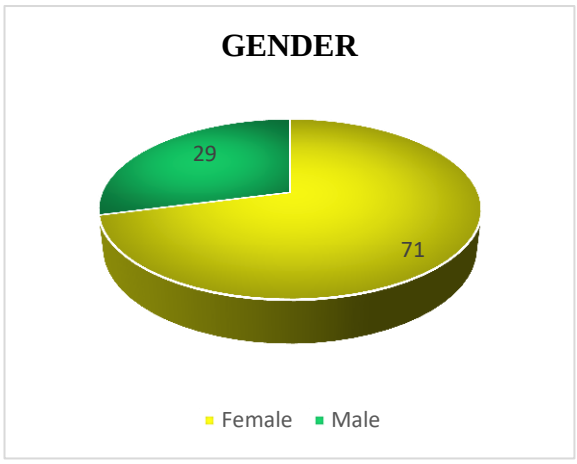
Occupation

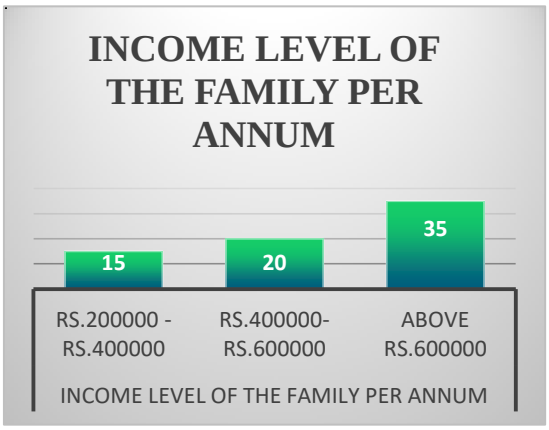
Occupation is a job or a profession, the way in which you spend your time earning something. The major finding of the study is that , majority of the respondents were from agricultural workers that is 61 percent of the respondents and 17 percent of the respondents were from daily wages and 14 percent of the respondents were from other field work and only 7 percent of the respondents were self - employed.

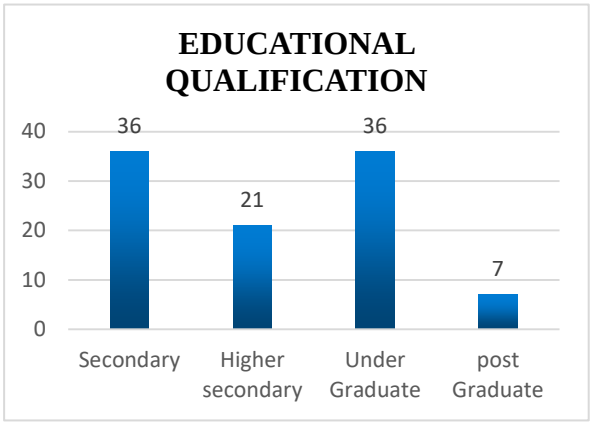
Area of locality

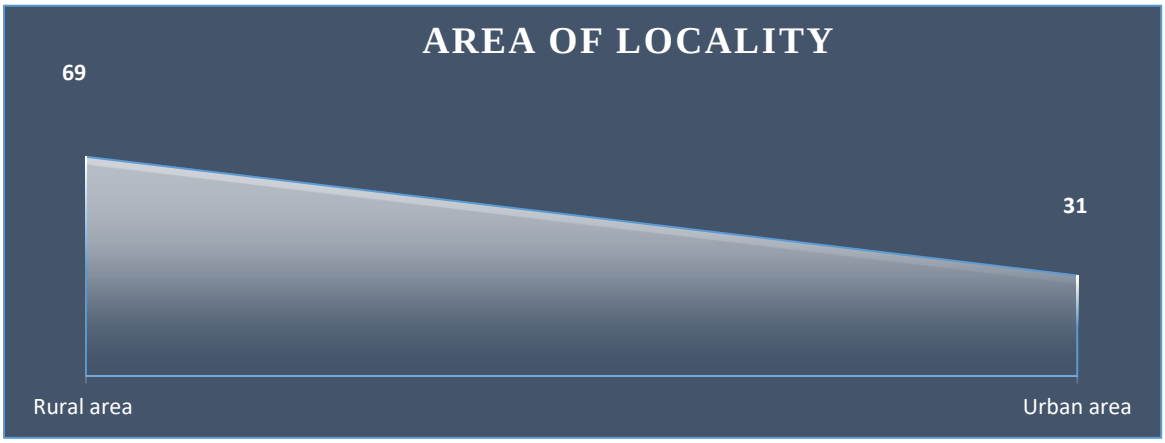
Area of the locality is a small area of a country or city. Out of 70 respondents the majority of the study was conducted in rural areas that is 69 percent of the respondents were collected from rural area and 31 percent of the respondents were collected from urban areas.

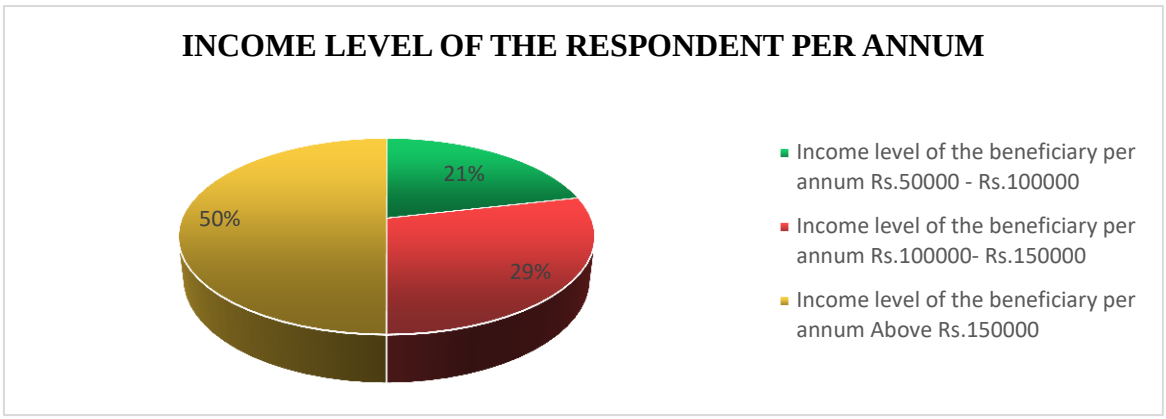

AGE GROUP
35
30
25
20
15
10
5
0
32
28
4
7
Above 20-30
Above 31-40
Above 41-50
Above 50

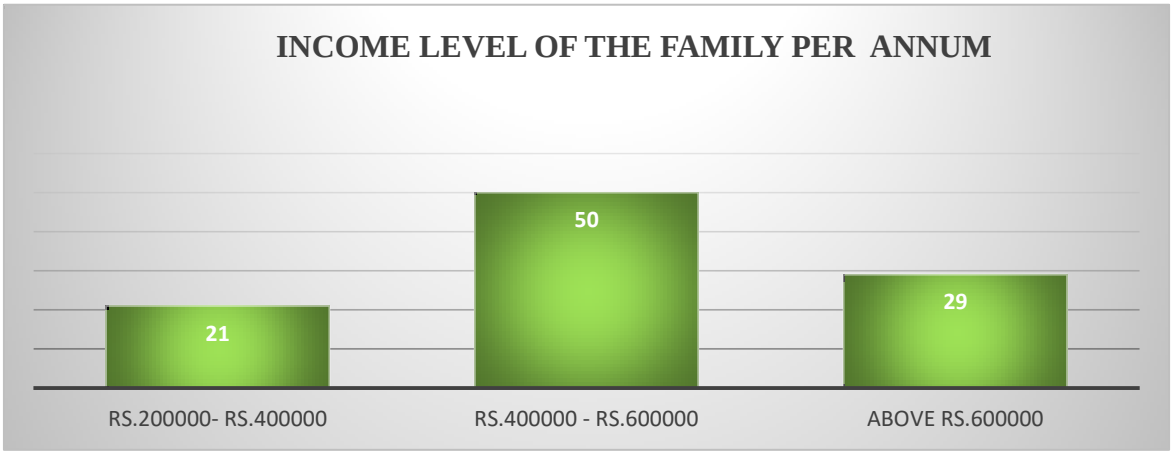

GENDER
29
71
Female
Male


INCOME LEVEL OF THE FAMILY PER ANNUM
15
20
35
RS.200000 - RS.400000
RS.400000- RS.600000
ABOVE RS.600000
INCOME LEVEL OF THE FAMILY PER ANNUM


EDUCATIONAL QUALIFICATION
40
30
20
10
0
36
21
36
7
Secondary
Higher secondary
Under Graduate
post Graduate


AREA OF LOCALITY
69
31
Rural area
Urban area





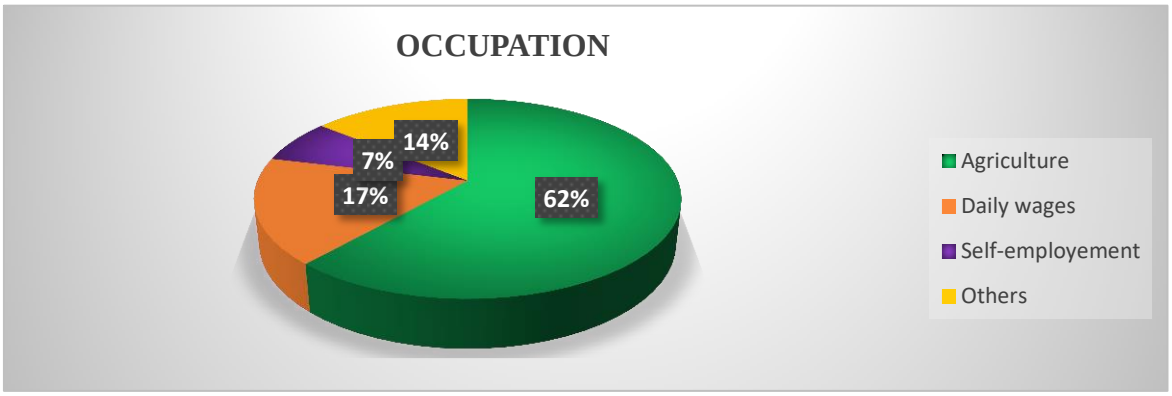


FIGURE 4.1.1

SOCIO ECONOMIC PROFILE OF THE RESPONDENTS

4.2 Rain Water Harvesting System

Rain water harvesting is the collection and storage of rain , rather than allowing it to runoff. Rain water is collected from a roof-like surface and redirected to a tank, cistern, deep pit , aquifer, or a reservoir with percolation, so that it seeps down and restores the ground water. Rain water harvesting system are depicted in Table -4.2.2.

TABLE 4.2.2

RAIN WATER HARVESTING SYSTEM

Aspects	Category	Frequency (n = 70)	Percentage of the Respondents
Source of knowing about rain water harvesting system	Other beneficiaries	37	53
	Government nnouncement	11	16
	Friends and relatives	10	14
	Mass media	7	10
	Others	5	7
Getting guidance to implement rain water harvesting system	Guidance by government fficials	20	29
	Own willingness	45	64
	Others	5	7
Cost of building a storage tank (Rs.)	Below 50000	25	36
	50000 - 100000	20	29
	100000 - 200000	20	28
	Above 200000	5	7

Improvement of income level after harvesting and usage of rain water	Yes	58	83
	No	12	17
Improvement in income level (Rs.)	5000 - 10000	4	7
	10000 - 15000	34	59
	15000 - 20000	17	29
	Above 20000	3	5

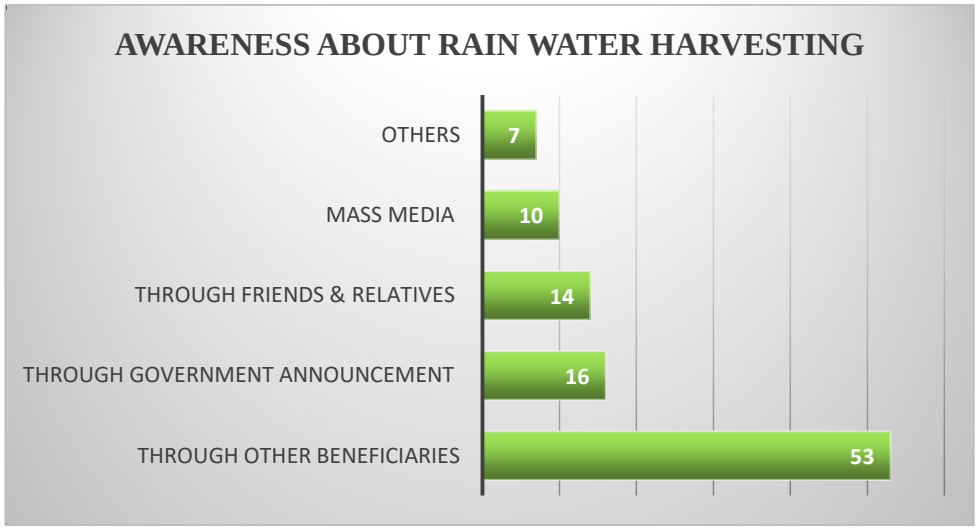
Among the selected respondents, 53 percent of the respondents were getting knowledge about rain water harvesting system from other beneficiaries who was already benefited by implementing rain water harvesting system, 16 percent of the beneficiaries were getting knowledge from government announcements,14 percent of the beneficiaries were getting knowledge through friends and relatives, only 10 percent of the respondents were getting knowledge from mass media and 7 percent of the beneficiaries were getting knowledge from others.

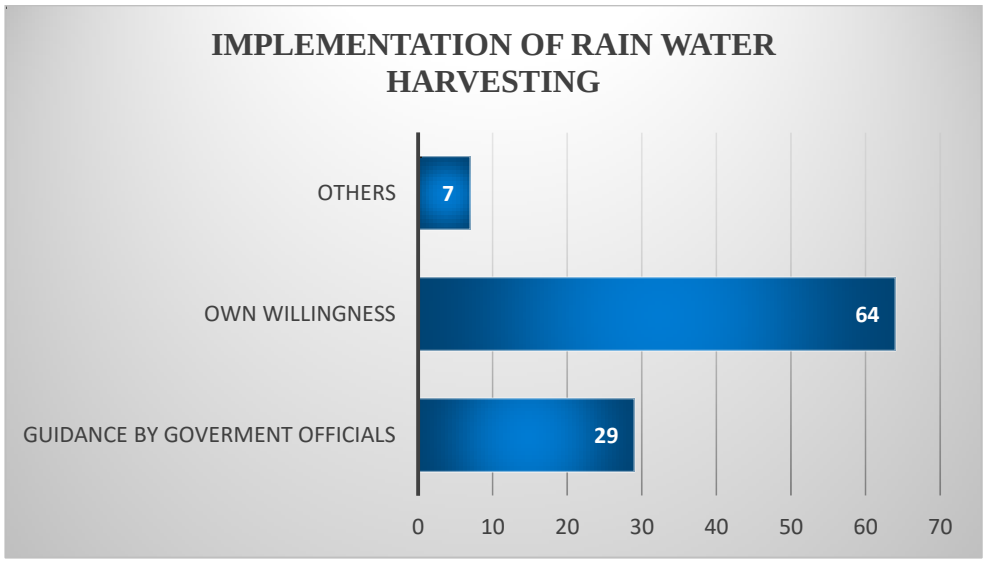
Most of the respondents were implemented the rain water harvesting system by their own willingness that is 64 percent , about 29 percent of the respondents were implementing the rain water harvesting system through the guidance by government officials, 7 percent of the respondents were implemented by others.

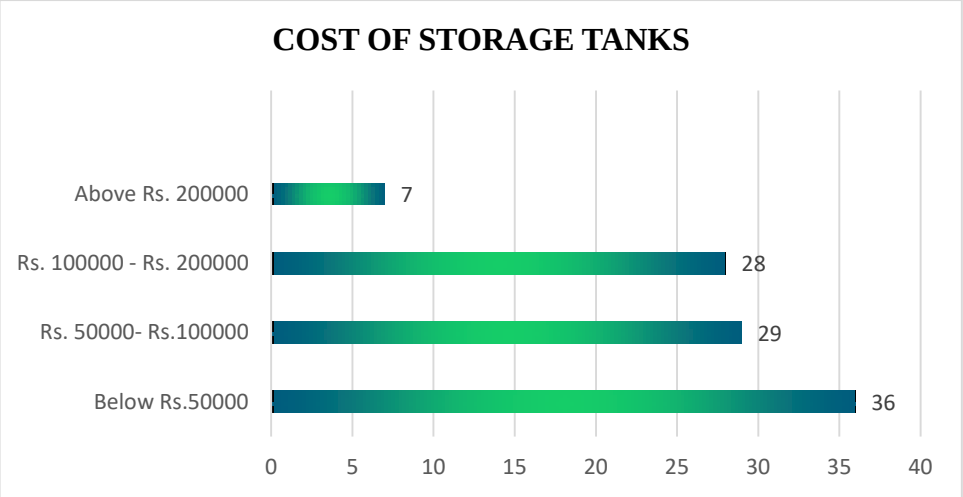
The study analyses the cost of building of the storage tank according to the respondents and capacity of the tank , 36 percent of the respondents were spending above Rs.50000 for building a storage tank, 29 percent of the respondents were spending upto Rs.50000 - Rs.100000, 28 percent of the respondents were spending upto Rs.100000 - Rs.200000 and only 7 percent of the respondents were spending above Rs.200000

Majority of the people were responding positively, that is 83 percent of the respondents were responding as that their income level were improved after harvesting and usage of rain water . The study also made a survey on their improvement of income level that is, 59 percent of the respondents were earning upto Rs.10000-Rs.15000 after harvesting and

usage of rain water, 30 percent of the respondents were earning upto Rs.15000-Rs.20000 only, 7 percent of the respondents were earning upto Rs.5000-Rs.10000 only, 5 percent of the respondents were earning above Rs.20000 after harvesting and usage of rain water. About 17 percent of the respondents were responding negatively.







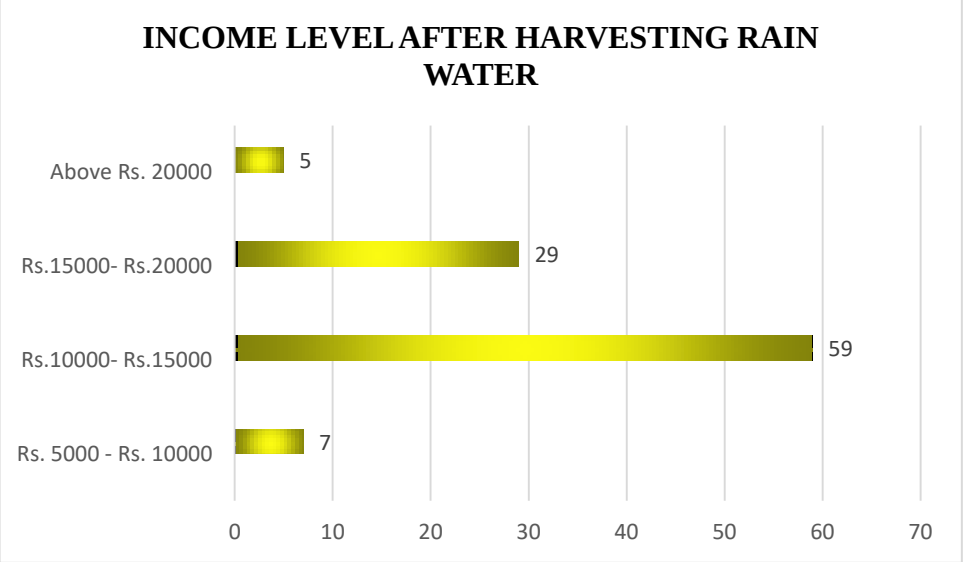


FIGURE 4.2.2

INFORMATION ABOUT RAIN WATER HARVESTING SYSTEM

4.3 Government Scheme for Rain Water Harvesting

Government scheme for rain water harvesting are depicted in Table 4.3.3

TABLE - 4.3.3

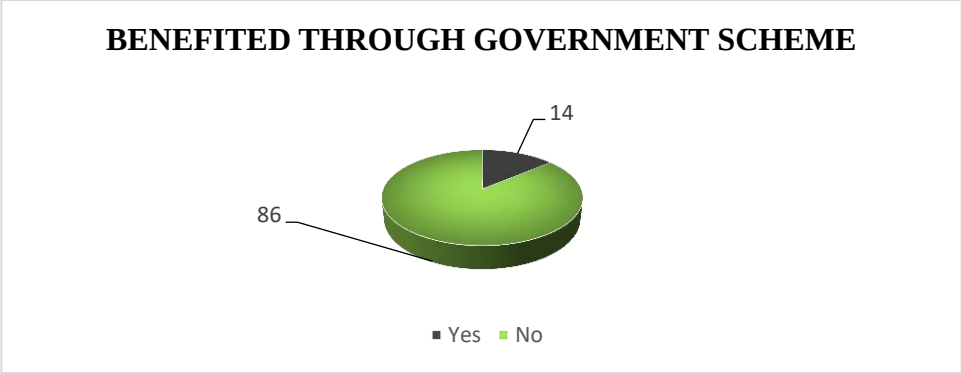
GOVERNMENT SCHEME FOR RAIN WATER HARVESTING

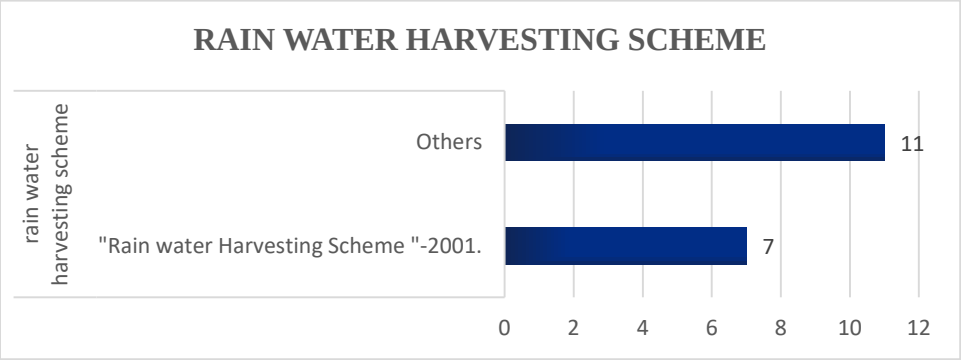
Aspects	Category	Frequency (n=70)	Percentage of the Respondents
The awareness about rain water harvesting scheme implemented by government	Agricultural officers of our locality	10	14
	Mass media	12	17
	Other beneficiaries near the locality	17	24
	Announcement by television	18	26
Benefited through government schemes	Yes	10	14
	No	60	86
Rain water harvesting scheme	"Rain water Harvesting Scheme "-2001.	5	7
	Others	8	11
Amount allocation for implementing rain water harvesting system by government	Yes	10	14
	No	60	86
	50% of estimated value	5	7
	25% of estimated value	5	7

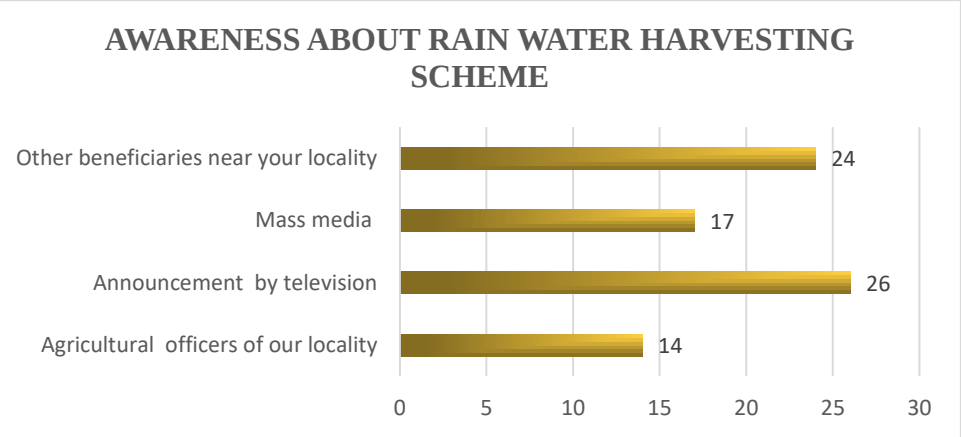
Most of the people were not benefited by any schemes allocated by government, that is out of 70 respondents only 10 respondents that is 14 percent of the respondents were benefited by government schemes allocated for rain water harvesting system even though not at all the ten respondents were exactly benefited through rain water harvesting scheme , only 7 percent that is 5 of the respondents were benefited through “Rain Water Harvesting Scheme”-2001, and others were benefited through other rain water harvesting related schemes. That is scheme for implementing the trip irrigation on agricultural land if the respondents were implemented rain water harvesting system.

From the study , majority of the respondents were getting awareness about rain water harvesting scheme implemented by government through announcement by television and advertisement given by televisions that is 29 percent of the respondents, 14 percent of the respondents were getting awareness through agricultural officers of their locality, 24 percent of the respondents were getting awareness from other beneficiaries near by their locality, 17 percent of the respondents were getting awareness from mass media and only 11 percent of the respondents were getting awareness from others.

Among the selected respondents, majority of the respondents were not getting any amount of allocation from government for implementing rain water harvesting system that is 71 percent of the respondents, that is they are implementing the rain water harvesting system through their own willingness, and 29 percent of the respondents were getting amount from government through scheme for implementing rain water harvesting system . From that 29 percent of positive response 17 percent of respondents were getting 25 percent of the estimated value as allocated amount from government and 11 percent of the respondents were getting 50 percent of the estimated value as allocated by government.







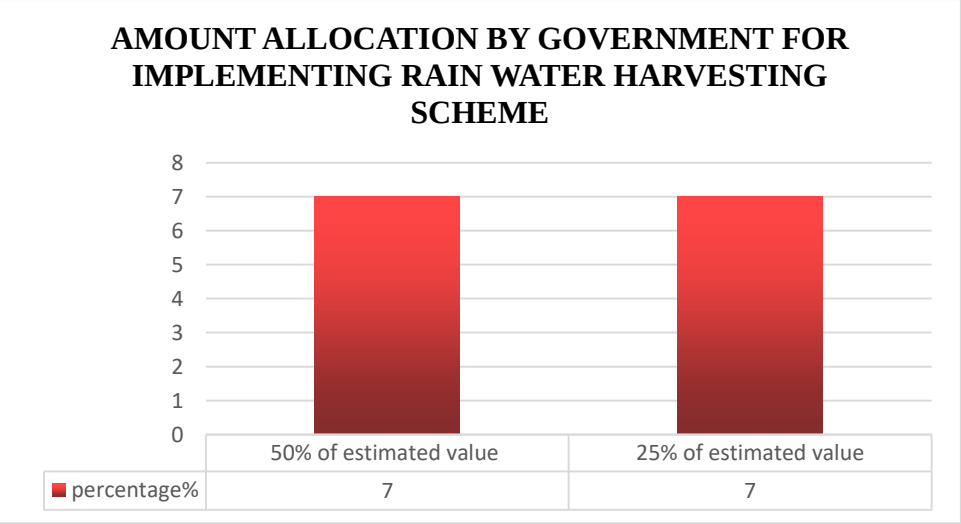


FIGURE 4.3.3

GOVERNMENT SCHEME FOR RAIN WATER HARVESTING

4.4 Technologies Implemented for Rain Water Harvesting and Water Resource Management

Usually, there are two basic ways of rain water harvesting like surface runoff harvesting and rooftop rainwater harvesting. These are the major technologies implemented for harvesting rain water. Technologies implemented for rain water harvesting and water resource management are depicted in Table 4.4.4.

TABLE 4.4.4

TECHNOLOGIES IMPLEMENTED FOR RAIN WATER HARVESTING AND WATER RESOURCE MANAGEMENT

Aspects	Category	Frequency (n = 70)	Percentage of the Respondents
Technology used for building a storage tank	Traditional method	35	50
	Trapaulin method	25	36
	Others	10	14
Techniques used to harvest a rain water	Surface runoff harvesting	25	36
	Rooftop rain water harvesting	20	29
	Building a rain saucer	15	21
	Others	10	14
Filtration technology used before preserving a rain water	Yes	20	29
	No	50	71
Preservation of the rain water for usage	3 months	12	17
	3-6 months	48	69
	6-9 months	10	14
Remedies to preserve the rain water after harvesting	Yes	20	29
	No	50	71

Storage capacity of rain water of the tank (liters)	Below 50000	38	54
	50000 - 100000	30	43
	Above 100000	2	3

Regarding the technologies used for building a storage tank, 50 percent of the respondents were using traditional method of building a storage tank, the traditional method is a tank construction method which is based on the bottom of tank as the reference plane, assemble each sheet of the tank wall starting from the bottom ring of tank, then assemble the sheet one by one from bottom to top until the whole tank constructed. About 36 percent of the respondents were using tarpaulin method for storage of rain water harvesting, tarpaulin is a inflatable pvc fabric sheet which is used to store the rain water in agricultural area where they want. Water tank tarpaulin high quality flexible inflatable pvc fabric for rain water container water storage tank, only 14 percent of the respondents were using other methods like storing the rain water in drums, barrels and normal runoff harvesting.

Among the selected respondents, 36 percent of the respondents were using surface runoff harvesting, 29 percent of the respondents were using rooftop rain water harvesting , 21 percent of the respondents were building a rain saucer using different techniques which is suitable for their places to harvest rain water.

Natural way of filtration

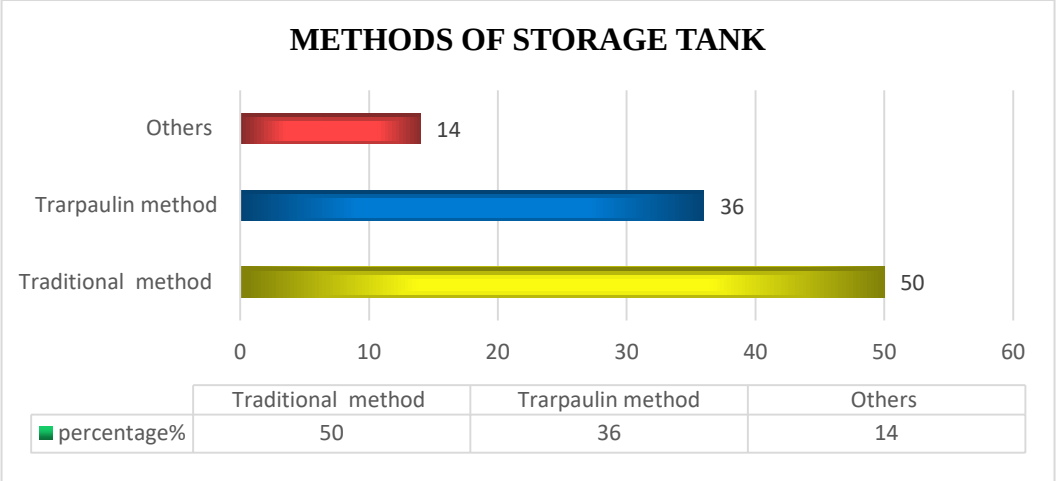
Filtration techniques used before preserving a rain water is that, Majority of the respondents were responding negatively that is 71 percent of the respondents , because most of the respondents were preserving rain water for agricultural and domestic purposes, so they don't use any filtration techniques, 29 percent of the respondents were responding positively that is Yes , because they were using harvested rain water for household and drinking purposes . The technique used to preserve a rain water is Natural way of filtering a rain water ,that is Sedimentation – making use of natural sediment is one of the easiest ways to filter water naturally as this involves the use of soil and rock. Sand will remove particles and if you're also using charcoal, it will aid as an active carbon (charcoal removes volatile organic compounds, chlorine, odor and taste). Another method of natural way of filtration is sand – using sand on its own will also work as this will pump the water through the sand by

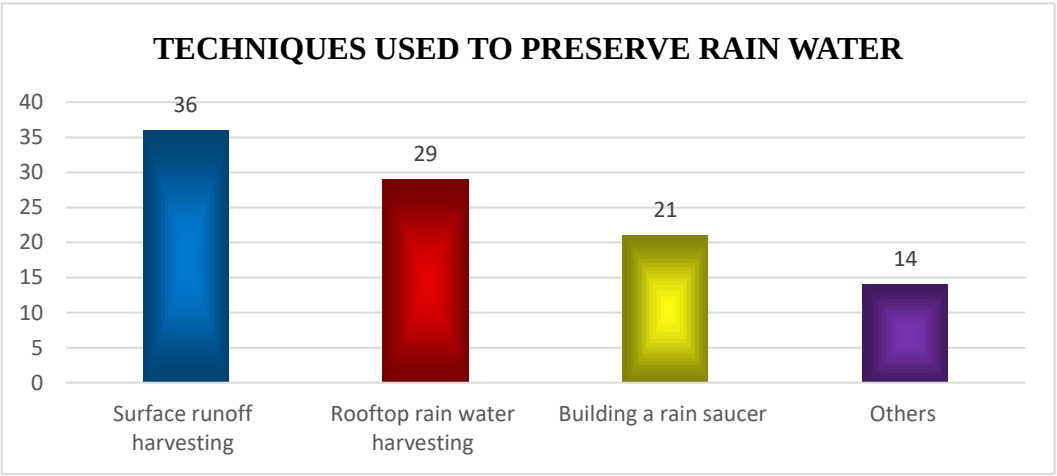
using either a slow sand filter method (removes certain pathogens), or a rapid gravity filter method (removes impurities and particles), there is no implementation of advanced techniques of filtration like microscopic filtration and mechanical Pre - tank filtration in a study area.

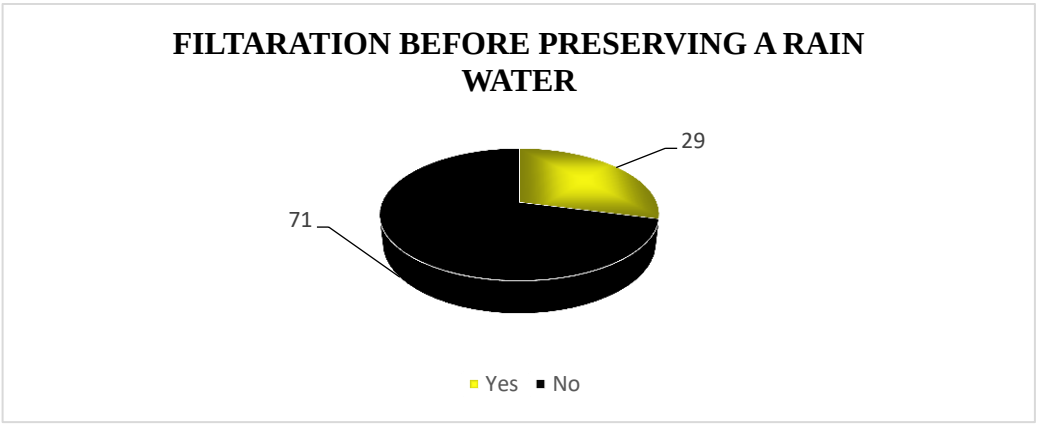
Among the selected respondents 69 percent of the respondents were preserving the harvested rain water for 3-6 months of usage , 14 percent of the respondents were preserving rain water for 6-9 month of usage , 17 percent of the respondents were preserving rain water for upto 3 months of usage and no one of the respondents in the study area were preserving rain water for more than 9 months.

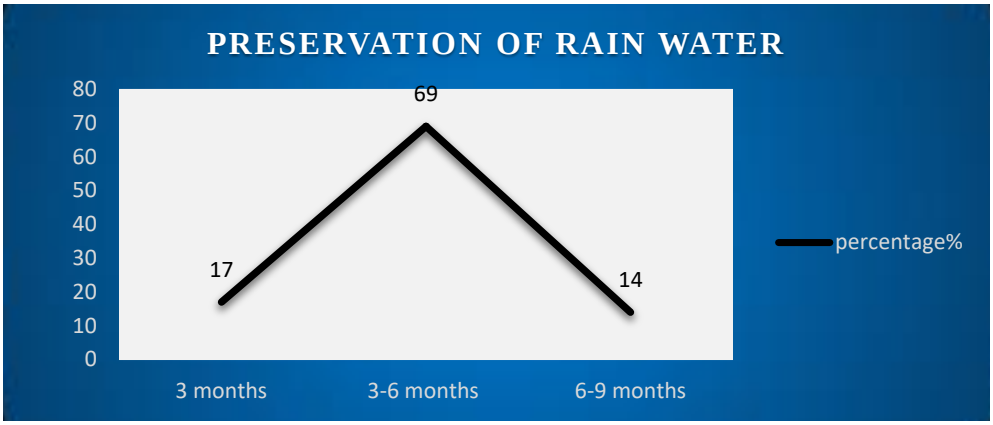
The study incorporates the information about that there is any remedies used before preserving a rain water , majority of the respondents were responding negatively, that is 71 percent of the respondents , because most of the respondents were preserving rain water for agricultural and domestic purposes so they don't use any remedies to preserve rain water, 29 percent of the respondents were responding positively , because they were using harvested rain water for household and drinking purposes . The remedies used before preserving a rainwater is poring the bleach powders or spreading coconut oil all over the harvested rain water will safeguard the rain water for long days of usage.

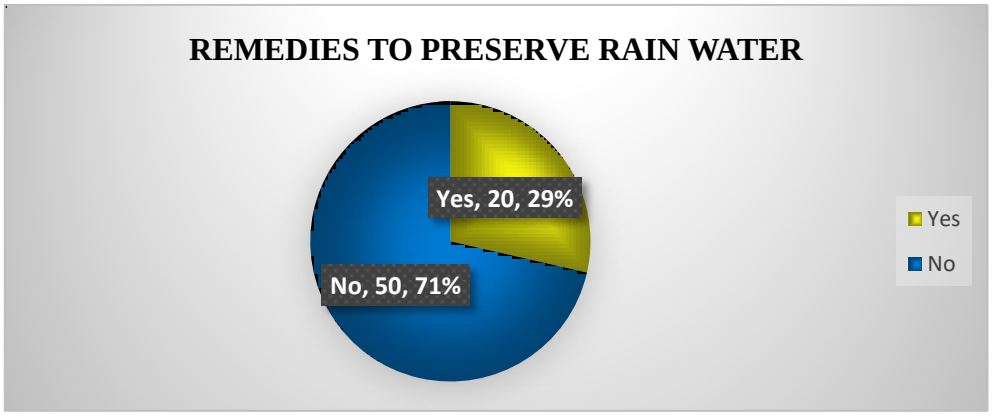
Among the selected respondents, 54 percent of the respondents were having below 50000 liters of storage tank , 43 percent of the respondents were having above 50000 liters to 100000 liters and only 3 percent of the respondents were having above 100000 liters of storage tank.


METHODS OF STORAGE TANK
Others
Trarpaulin method
Traditional method
14
36
50
0
10
20
30
40
50
60
Traditional method
Trarpaulin method
Others
percentage%
50
36
14


TECHNIQUES USED TO PRESERVE RAIN WATER
40
35
30
25
20
15
10
5
0
36
29
21
14
Surface runoff harvesting
Rooftop rain water harvesting
Building a rain saucer
Others


FILTARATION BEFORE PRESERVING A RAIN WATER
29
71
Yes
No





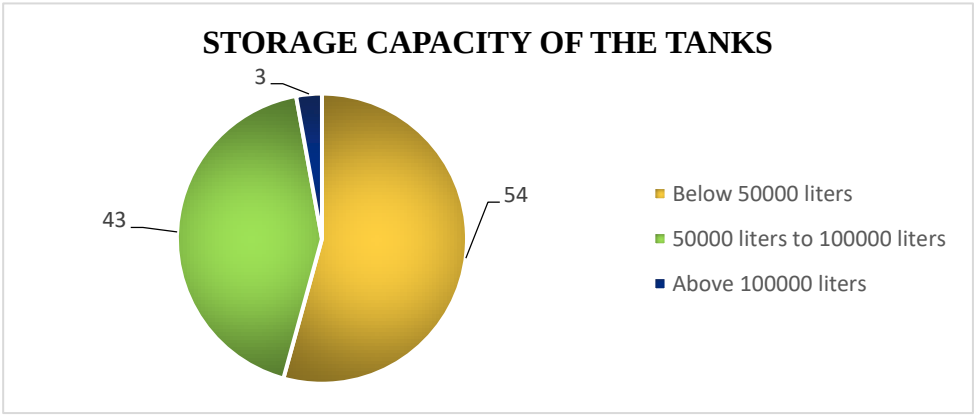


FIGURE 4.4.4

TECHNOLOGIES IMPLEMENTED FOR RAIN WATER HARVESTING ANDE WATER RESOURCE MANAGEMENT

4.5 Source and Benefits of Rain Water Harvesting

Rain water harvesting is the collection and storage of rain, rather than allowing it to runoff. Rain water is collected from a roof-like surface and redirected to a tank, cistern, deep pit like well, shaft, or borehole, aquifer or a reservoir with percolation , so that it seeps down and restore the ground water. Source of rain water harvesting are depicted in Table 4.5.1

TABLE 4.5.1

SOURCE OF RAIN WATER HARVESTING

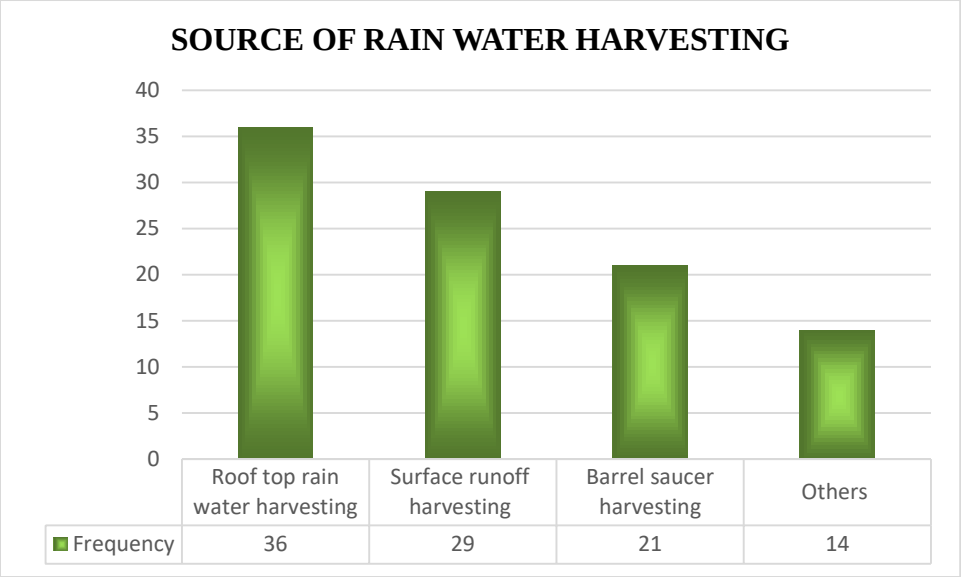
Aspects	Category	Frequency (N=70)	Percentage of the Respondents
Creating a source for rain water harvesting	Roof top rain water harvesting	25	36
	Surface runoff harvesting	20	29
	Barrel saucer harvesting	15	21
	Others	10	14
Preservation resource of rain water harvesting	Store rain water in drums	15	21
	Direct rain water runoff to RC tanks using pipes and setting bowls	35	50
	Directed to borewell to get refilled	20	29

Surface runoff rainwater harvesting is a method of collecting rainwater flowing along the ground during the rains will be collected to a tanks or in the open small ponds below the surface of the ground for irrigation or to increase ground water level and other purposes. Among the selected respondents, 36 percent of the respondents were using surface runoff harvesting.

The rooftop rainwater harvesting is a method from which rainwater is captured from the roof catchments which is then stored in reservoirs and by adopting artificial recharge techniques to meet the household needs and for agricultural purposes through storage in tanks. Among the selected respondents , 29 percent of the respondents were using rooftop rain water harvesting.

Looking like an upside-down umbrella, the rain saucer unfolds to form a funnel which fills the containers with rainwater. Since this easy-to-deploy system catches rain straight from the sky, it also decreases the chances of contamination. Among the selected respondents, 21 percent of the respondents were building a rain saucer using different techniques which is suitable for their places to harvest rain water.

The study highlights the information about how the respondents were creating a preservation resource for harvesting a rain water is that 50 percent of the respondents were using direct rain water runoff to RC tanks using pipes and setting bowls ,29 percent of the respondents were direct the water runoff directly near to borewell to get refilled and increasing of ground water level , 21 percent of the respondents were store rain water in drums using pipes.



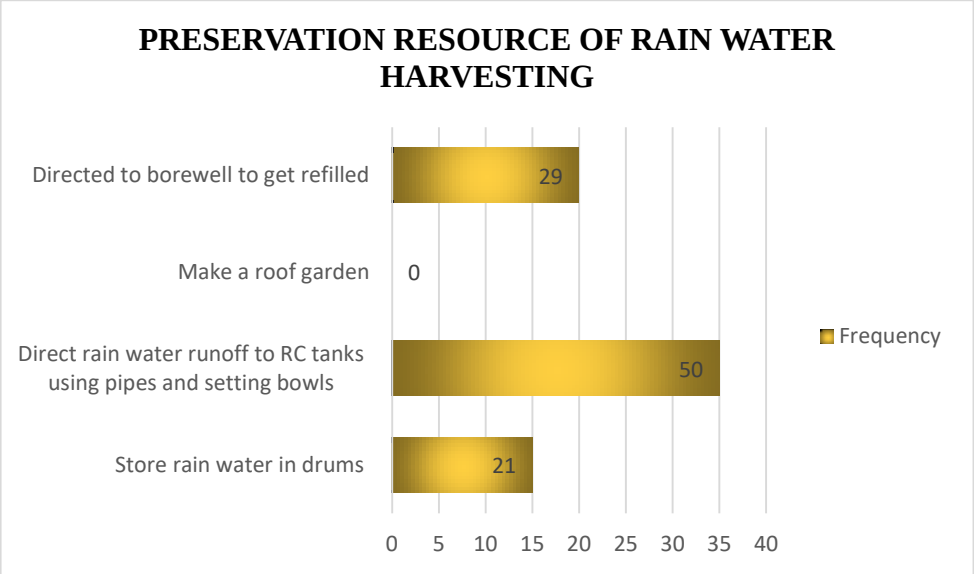


FIGURE 4.5.1

SOURCE OF RAIN WATER HARVESTING

4.5 Source and Benefits of Rain Water Harvesting

Rain water harvesting is benefited in many way for human beings in day to day life. Rainwater harvesting is a technique used for collecting, storing and using rain water for landscape irrigation and other uses. It will reduce water bills, provide an alternative supply during water restriction and help maintain a green, healthy garden, mostly for agricultural and domestic purposes in rural areas. Benefits of rain water harvesting are depicted in Table 4.5.2

TABLE 4.5.2

BENEFITS OF RAIN WATER HARVESTING

Aspects	Category	Frequency (n = 70)	Percentage of the Respondents
Usage of harvested rain water	Agricultural purposes	47	67
	Water for wildlife, pets or livestock	12	17
	Human consumption like drinking and cooking	10	14
	Others	1	1
Usefulness of rain water harvesting	Useful	70	100
	Save money	15	21
	Reduces water bills	35	50
	More gardening facility	12	17
	others	8	11
Benefits of using harvested rain water for agricultural purpose	Excellent	38	54
	Good	28	40
	Not bad	4	6

Types of crops cultivated using rain water	Pulses	20	29
	Vegetables	40	57
	Corn varieties	4	6
	Others	6	9
Types of advantages after harvesting rain water	Reduces water bills	7	10
	Ecological benefits	3	4
	Adequate means for irrigation purposes	34	49
	Reduce demand on ground water	24	34
	Others	2	3

The rain water is used for multiple purposes but the major finding is that majority of the respondents that is 67 percent of the respondents were using the harvested rain water for agricultural purposes , 17 percent of the respondents were using for the domestic purpose and livestock, 14 percent of the respondents were using for human consumption like drinking and cooking.

Majority 100 percent (Multiple response) of the respondents were also responding positively about the benefits of rain water harvesting. The usage and benefits of rain water harvesting is that, 50 percent of the respondents were stated that their water bills were reducing after harvesting and usage of rain water , 21 percent of the respondents were stated they save money by harvesting and using the rain water , 17 percent of the respondents were expressed as they were benefited by more gardening facilities due to rain water harvesting , 11 percent of the respondents were responding as they were benefited by other fields like domestic purposes and house hold consumption.

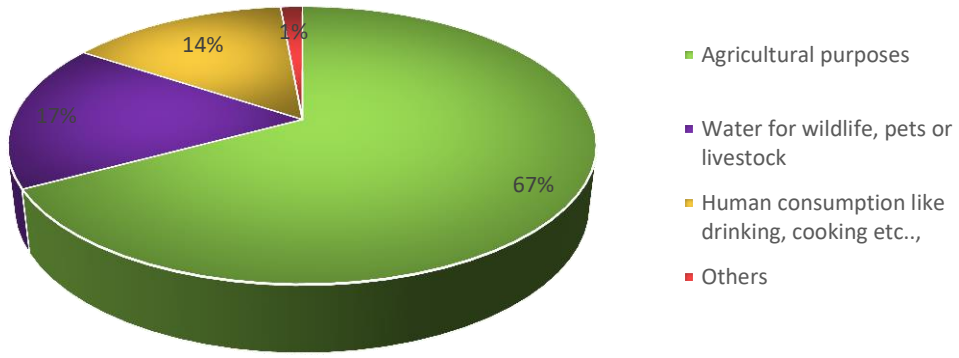
Among the selected respondents , majority of the respondents using the harvested rain water for agricultural purpose , and the study also finds that how much that the harvested rain water benefited for agricultural purpose that is , 38 percent of the respondents were

responding as it works excellently , 28 percent of the respondents stated that it works good and only, 4 percent of the respondents were responding as not bad. Finally through the study almost it become positive response from the respondents.

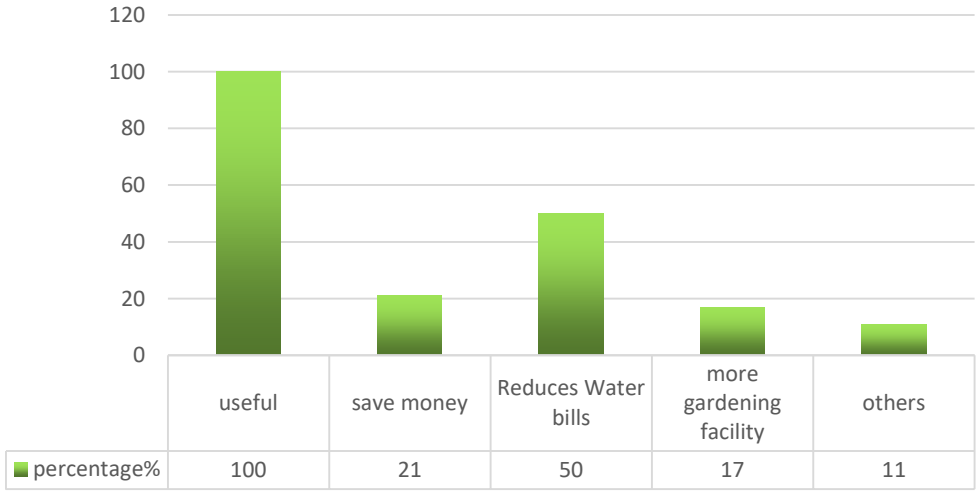
With the help of harvested rain water in the study area,the respondents were cultivating different types of crops that is, 57 percent of the respondents were cultivating vegetables in their land with the help of harvested rain water , 29 percent of the respondents were cultivating pulses, 6 percent of the respondents were cultivating corn varieties and 9 percent of the respondents were cultivating other crops like sorghum, groundnut and cotton.

The study highlights the advantages of after harvesting rain water that is 49 percent of the respondents were benefited by adequate means for irrigation purpose , 34 percent of the respondents were beneficial by reducing demand on ground water level, 10 percent of the respondents were benefited by reducing their water bills and only 4 percent of the respondents were ecologically benefited by harvesting rain water.

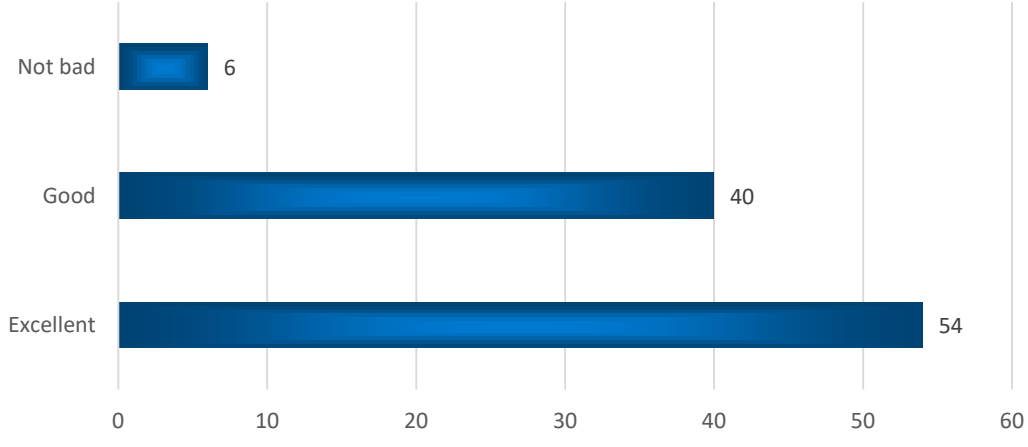
USAGE OF HARVESTED RAIN WATER

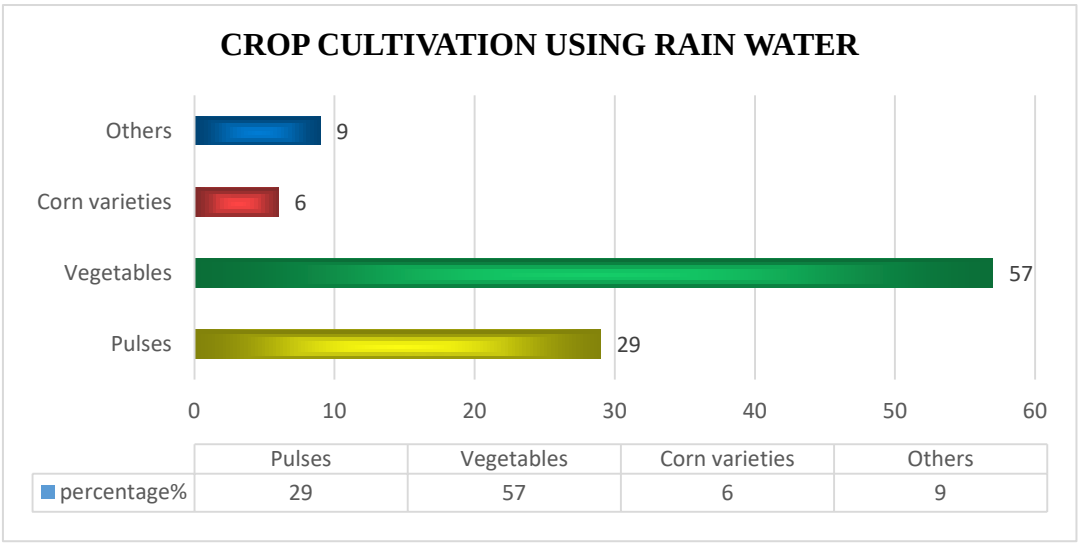


USEFULNESS OF RAIN WATER HARVESTING



BENEFITS OF HARVESTED RAIN WATER FOR AGRICULTURAL PURPOSES





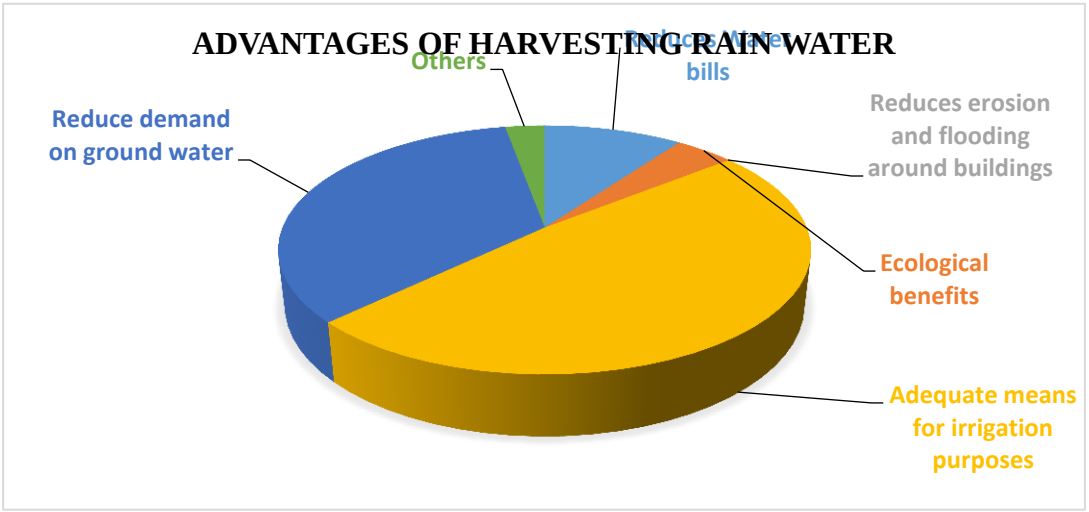


FIGURE 4.5.2

BENEFITS OF RAIN WATER HARVESTING

4.6 Improvement of Ground Water Level Through Rain Water Harvesting and Water Resource Management

Ground water is the water present beneath earth's surface in rock and soil pore spaces and in the fractures of rock formations. Improvement of ground water level through rain water harvesting and water resource management are depicted in Table 4.6.6.

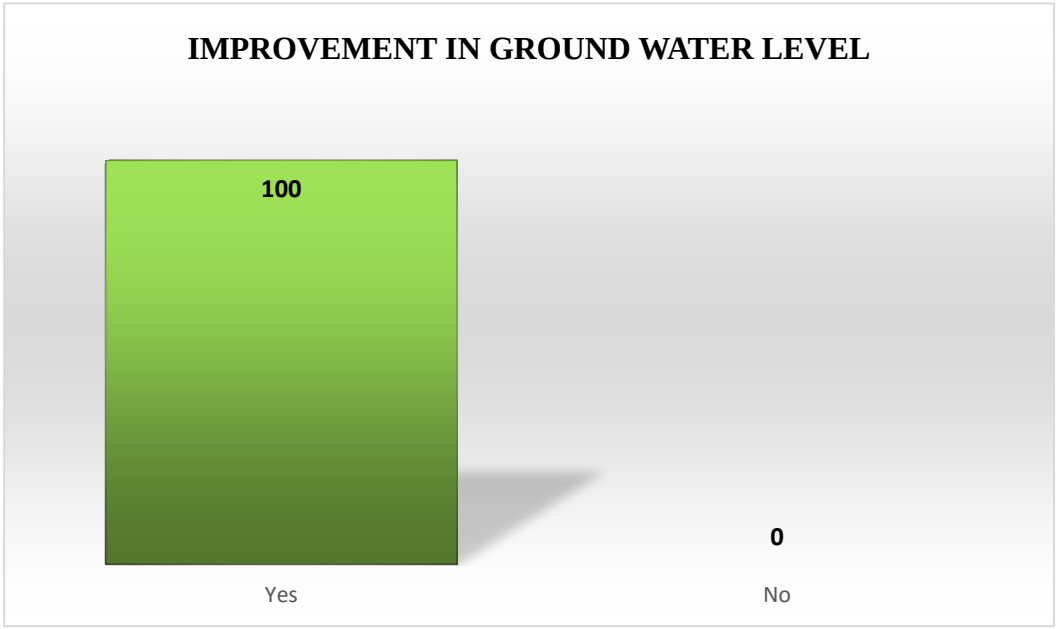
TABLE 4.6.6

IMPROVEMENT OF GROUND WATER LEVEL THROUGH RAIN WATER HARVESTING AND WATER RESOURCE MANAGEMENT

Aspects	Category	Frequency (n = 70)	Percentage of the Respondents
Rain water harvesting increases ground water level	Yes	70	100
	No	0	0
Ideas implemented to increases ground water level through rain water harvesting	Direct rain water runoff to ponds to recharge groundwater level	43	61
	Store the rain water in the pond near to borewell to refill ground water level	23	34
	Preserve the rain water near to wells to increase groundwater level	3	4
	Others	1	1

Majority of the respondents stated that due to rain water harvesting there is an increase in groundwater level that is almost 100 percent of the respondents were responding positively, there is no negative response about increase in groundwater level by harvesting rain water.

The study also find outs the ideas implemented to increase ground water level through rain water harvesting is that, 61 percent of the respondents were using the direct rain water runoff to ponds to recharge ground water level, 34 percent of the respondents were stored the rain water in the ponds near to borewell to refill the ground water level, 4 percent of the respondents were preserving the rain water near to wells to increase ground water level.



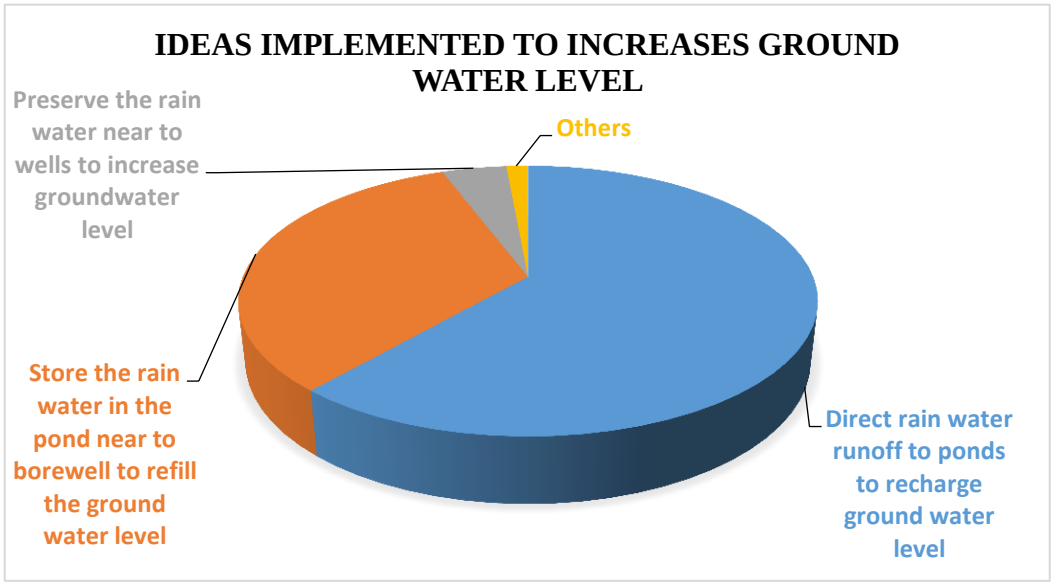


FIGURE 4.6.6

IMPROVEMENT OF GROUND WATER LEVEL THROUGH RAIN WATER HARVESTING AND WATER RESOURCE MANAGEMENT

SUMMARY AND CONCLUSION

Rainwater harvesting is a simple method by which rainfall is collected for future usage. The collected rainwater may be stored, utilized in different ways or directly used for recharge purposes. With depleting groundwater levels and fluctuating climate conditions, RWH can go a long way to help mitigate these effects. Capturing the rainwater can help recharge local aquifers, reduce urban flooding and most importantly ensure water availability in water-scarce zones. Though the term seems to have picked up greater visibility in the last few years, it was, and is even today, a traditional practice followed in rural India. This water conservation method can be easily practiced in individual homes, apartments, parks, offices and temples too, across the world. Farmers have recharged their dry borewells, created water banks in drought areas, greened their farms, increased sustainability of their water resources and even created a river. Technical know how for the rooftop Rain Water Harvesting with direct storage can be availed for better implementation. Rain water harvesting, An effective method in water scarce times, it is also an easily doable practice. Hence the study on Rain Water Harvesting and Water Resource Management on selected villages of Tirupur District has the following objectives:

- To know the Socio-economic background of the Respondents
- To Identify the Techniques used for Rain Water Harvesting
- To asses the different Technologies Implemented for Rain Water Harvesting
- To analyse the Water Management Resource and Preservation Methods
- To analyse the Benefits and Usage of Rain Water Harvesting
- Assessment of Quantity of Rainwater Harvested in numbers of underground Storage tanks

The total sample size was 70 and the samples were drawn from selected villages of Tirupur district. The present study was based on primary data collection. All these respondents were collected from different destination of the selected villages of Tirupur district. Interview method was the method used for conducting the study. Interview schedule was the tool used to collect the data.

The finding of the study was summarized under the following headings:

4.1 Socio Economic Profile of the Respondents

4.2 Rain Water Harvesting System

4.3 Government Scheme for Rain Water Harvesting

4.4 Technologies implemented for Rain Water Harvesting and Water Resource Management

4.5 Source and Benefits of Rain Water Harvesting

4.6 Improvement of Ground Water Level Through Rain Water Harvesting and Water Resource Management

In the Socio economic profile of the respondents , personal details like age, gender, educational qualification, area of the locality, income level and occupation are discussed. Majority of the respondent were female under the age group of 31 to 40 years , mostly the study was conducted in rural area , so the respondents are mainly depending on agricultural field.

Age as a factor, determines the vitality of the organizational ability and the attitude and their interest and response towards any challenging activity. The age profile of the selected respondents revealed that 46 percent of the respondents were between the age group of 31-40 years, 40 percent of the respondents were between the age group of above 41-50 years, 10 percent of the respondents were in the category of above 50 years and only 4 percent of the response were belongs to age group of above 20-30 years. Gender is the range of characteristics differentiating between masculinity and feminity. Majority of 71 percent of the respondents were female and only 29 percent of the respondents were male. Education is an important element in human resource development . The present study also highlights the educational qualification of the respondents, there is an equal percent of response from secondary and graduates of 36 percentage, 21 percent of the respondents completed higher secondary education and only 7 percent of the respondents were studied upto post graduates. The study also gives the information about the income level of the respondents per annum that is , 50 percent of the respondents were earning above Rs.150000 per annum , 29 percent

of the response were earning upto Rs.100000 to Rs.150000 , and only 21 percent of the respondents were earning upto Rs.50000 to Rs.100000. Among the selected respondents, 50 percent of the family were earning above Rs. 600000. About 29 percent of the family were earning upto Rs.400000 to Rs. 600000 and only 21 percent of the family were earning upto Rs.200000 to Rs. 400000. Occupation is a job or a profession, the way in which you spend your time earning something. The major finding of the study is that , majority of the respondents were from agricultural workers that is 61 percent of the respondents and 17 percent of the respondents were from daily wages and 14 percent of the respondents were from other field work and only 7 percent of the respondents were self - employed. Area of the locality is a small area of a country or city. Out of 70 respondents the majority of the study was conducted in rural areas that is 69 percent of the respondents were collected from rural area and 31 percent of the respondents were collected from urban areas.

Majority of the respondents are getting awareness from other beneficiaries who are already implemented the rain water harvesting system in their locality and some others are getting awareness from government announcements and friends and relatives. Most of the respondents are implementing the rain water harvesting system in their field by their own willingness and some of them are implementing through the guidance from government officials like agricultural officers and others. The study also investigates the improvement of the income level after harvesting and usage of rain water, majority of the respondent are responding that there is a huge level of improvement in their income level after harvesting and usage of rain water. Among the selected respondents, 53 percent of the respondents were getting knowledge about rain water harvesting system from other beneficiaries who was already benefited by implementing rain water harvesting system, 16 percent of the beneficiaries were getting knowledge from government announcements,14 percent of the beneficiaries were getting knowledge through friends and relatives, only 10 percent of the respondents were getting knowledge from mass media and 7 percent of the beneficiaries were getting knowledge from others. Most of the respondents were implemented the rain water harvesting system by their own willingness that is 64 percent , about 29 percent of the respondents were implementing the rain water harvesting system through the guidance by government officials, 7 percent of the respondents were implemented by others. The study analyses the cost of building of the storage tank according to the respondents and capacity of the tank , 36 percent of the respondents were spending above Rs.50000 for building a storage tank, 29 percent of the respondents were spending upto Rs.50000 - Rs.100000, 28 percent of

the respondents were spending upto Rs.100000 - Rs.200000 and only 7 percent of the respondents were spending above Rs.200000. Majority of the people were responding positively, that is 83 percent of the respondents were responding as that their income level were improved after harvesting and usage of rain water . The study also made a survey on their improvement of income level that is, 59 percent of the respondents were earning upto Rs.10000-Rs.15000 after harvesting and usage of rain water, 30 percent of the respondents were earning upto Rs.15000-Rs.20000 only, 7 percent of the respondents were earning upto Rs.5000-Rs.10000 only, 5 percent of the respondents were earning above Rs.20000 after harvesting and usage of rain water. About 17 percent of the respondents were responding negatively.

The study also find outs the techniques and technologies implemented for rain water harvesting in the locality , most of the study area respondents are using the traditional method of building storage tank and some of them are using trapaulin method for storage of harvested rain water , the techniques used to harvest the rain water is surface runoff , rooftop rain water harvesting and building rain saucer , most of the respondent are not using any filtration techniques because they are harvesting the rain water for agricultural purposes, the respondent who are harvesting the rain water for human consumption like drinking, cooking, etc., are using the natural way of filtration. The study also discuss the storage capacity of the tanks. Most of the people were not benefited by any schemes allocated by government, that is out of 70 respondents only 10 respondents that is 14 percent of the respondents were benefited by government schemes allocated for rain water harvesting system even though not at all the ten respondents were exactly benefited through rain water harvesting scheme , only 7 percent that is 5 of the respondents were benefited through "Rain Water Harvesting Scheme"-2001, and others were benefited through other rain water harvesting related schemes. That is scheme for implementing the trip irrigation on agricultural land if the respondents were implemented rain water harvesting system. From the study , majority of the respondents were getting awareness about rain water harvesting scheme implemented by government through announcement by television and advertisement given by televisions that is 29 percent of the respondents, 14 percent of the respondents were getting awareness through agricultural officers of their locality, 24 percent of the respondents were getting awareness from other beneficiaries near by their locality, 17 percent of the respondents were getting awareness from mass media and only 11 percent of the respondents were getting awareness from others. Among the selected respondents, majority of the respondents were

not getting any amount of allocation from government for implementing rain water harvesting system that is 71 percent of the respondents, that is they are implementing the rain water harvesting system through their own willingness, and 29 percent of the respondents were getting amount from government through scheme for implementing rain water harvesting system . From that 29 percent of positive response 17 percent of respondents were getting 25 percent of the estimated value as allocated amount from government and 11 percent of the respondents were getting 50 percent of the estimated value as allocated by government.

From the study , we will gather the sources of rain water harvesting from the respondents point of view , the major source for rain water harvesting is rooftop rain water harvesting and surface runoff harvesting, the preservation resource are mostly storing the rain water directly in RC tanks using pipes and setting bowls. Regarding the technologies used for building a storage tank, 50 percent of the respondents were using traditional method of building a storage tank, the traditional method is a tank construction method which is based on the bottom of tank as the reference plane, assemble each sheet of the tank wall starting from the bottom ring of tank, then assemble the sheet one by one from bottom to top until the whole tank constructed. About 36 percent of the respondents were using tarpaulin method for storage of rain water harvesting, tarpaulin is a inflatable pvc fabric sheet which is used to store the rain water in agricultural area where they want. Water tank tarpaulin high quality flexible inflatable pvc fabric for rain water container water storage tank, only 14 percent of the respondents were using other methods like storing the rain water in drums, barrels and normal runoff harvesting. Among the selected respondents, 36 percent of the respondents were using surface runoff harvesting, 29 percent of the respondents were using rooftop rain water harvesting , 21 percent of the respondents were building a rain saucer using different techniques which is suitable for their places to harvest rain water. Natural way of filtration: Filtration techniques used before preserving a rain water is that, Majority of the respondents were responding negatively that is 71 percent of the respondents , because most of the respondents were preserving rain water for agricultural and domestic purposes, so they don't use any filtration techniques, 29 percent of the respondents were responding positively that is Yes , because they were using harvested rain water for household and drinking purposes . The technique used to preserve a rain water is Natural way of filtering a rain water ,that is Sedimentation – making use of natural sediment is one of the easiest ways to filter water naturally as this involves the use of soil and rock. Sand will remove particles and if you're

also using charcoal, it will aid as an active carbon (charcoal removes volatile organic compounds, chlorine, odor and taste). Another method of natural way of filtration is sand – using sand on its own will also work as this will pump the water through the sand by using either a slow sand filter method (removes certain pathogens), or a rapid gravity filter method (removes impurities and particles), there is no implementation of advanced techniques of filtration like microscopic filtration and mechanical Pre - tank filtration in a study area. Among the selected respondents 69 percent of the respondents were preserving the harvested rain water for 3-6 months of usage , 14 percent of the respondents were preserving rain water for 6-9 month of usage , 17 percent of the respondents were preserving rain water for upto 3 months of usage and no one of the respondents in the study area were preserving rain water for more than 9 months. The study incorporates the information about that there is any remedies used before preserving a rain water , majority of the respondents were responding negatively, that is 71 percent of the respondents , because most of the respondents were preserving rain water for agricultural and domestic purposes so they don't use any remedies to preserve rain water, 29 percent of the respondents were responding positively , because they were using harvested rain water for household and drinking purposes . The remedies used before preserving a rainwater is poring the bleach powders or spreading coconut oil all over the harvested rain water will safeguard the rain water for long days of usage. Among the selected respondents, 54 percent of the respondents were having below 50000 liters of storage tank , 43 percent of the respondents were having above 50000 liters to 100000 liters and only 3 percent of the respondents were having above 100000 liters of storage tank.

The study gives the information about the benefits of rain water harvesting, all the respondents are responding positively about rain water harvesting and its saves their money by using rain water and it also reduces water bills , it gives more gardening facilities too. The harvested rain water are mostly used for agricultural purposes and it is so much beneficial for agriculture. By using harvested rain water crops like pulses , vegetables, corn varieties are cultivated in the study area. The major benefits of harvesting rain water is that reduces water bills, ecological benefits and adequate means for irrigation and it also increases ground water level and reduces water scarcity. Surface runoff rainwater harvesting is a method of collecting rainwater flowing along the ground during the rains will be collected to a tanks or in the open small ponds below the surface of the ground for irrigation or to increase ground water level and other purposes. Among the selected respondents, 36 percent of the respondents were using surface runoff harvesting.

The rooftop rainwater harvesting is a method from which rainwater is captured from the roof catchments which is then stored in reservoirs and by adopting artificial recharge techniques to meet the household needs and for agricultural purposes through storage in tanks. Among the selected respondents , 29 percent of the respondents were using rooftop rain water harvesting. Looking like an upside-down umbrella, the rain saucer unfolds to form a funnel which fills the containers with rainwater. Since this easy-to-deploy system catches rain straight from the sky, it also decreases the chances of contamination. Among the selected respondents, 21 percent of the respondents were building a rain saucer using different techniques which is suitable for their places to harvest rain water.

The study highlights the information about how the respondents were creating a preservation resource for harvesting a rain water is that 50 percent of the respondents were using direct rain water runoff to RC tanks using pipes and setting bowls ,29 percent of the respondents were direct the water runoff directly near to borewell to get refilled and increasing of ground water level , 21 percent of the respondents were store rain water in drums using pipes.The rain water is used for multiple purposes but the major finding is that majority of the respondents that is 67 percent of the respondents were using the harvested rain water for agricultural purposes , 17 percent of the respondents were using for the domestic purpose and livestock, 14 percent of the respondents were using for human consumption like drinking and cooking. Majority 100 percent (Multiple response) of the respondents were also responding positively about the benefits of rain water harvesting. The usage and benefits of rain water harvesting is that, 50 percent of the respondents were stated that their water bills were reducing after harvesting and usage of rain water , 21 percent of the respondents were stated they save money by harvesting and using the rain water , 17 percent of the respondents were expressed as they were benefited by more gardening facilities due to rain water harvesting , 11 percent of the respondents were responding as they were benefited by other fields like domestic purposes and house hold consumption. Among the selected respondents , majority of the respondents using the harvested rain water for agricultural purpose , and the study also finds that how much that the harvested rain water benefited for agricultural purpose that is , 38 percent of the respondents were responding as it works excellently , 28 percent of the respondents stated that it works good and only, 4 percent of the respondents were responding as not bad. Finally through the study almost it become positive response from the respondents. With the help of harvested rain water in the study area,the respondents were cultivating different types of crops that is, 57 percent of the respondents

were cultivating vegetables in their land with the help of harvested rain water , 29 percent of the respondents were cultivating pulses, 6 percent of the respondents were cultivating corn varieties and 9 percent of the respondents were cultivating other crops like sorghum, groundnut and cotton. The study highlights the advantages of after harvesting rain water that is 49 percent of the respondents were benefited by adequate means for irrigation purpose , 34 percent of the respondents were beneficial by reducing demand on ground water level, 10 percent of the respondents were benefited by reducing their water bills and only 4 percent of the respondents were ecologically benefited by harvesting rain water.

The study also gives the information about the respondents benefited through government scheme allocated for implementing rain water harvesting system , mostly the respondents are not benefited through the government scheme and some of the respondent are benefited through government scheme and they getting the certain percentage of amount for implementing rain water harvesting scheme in their locality.Majority of the respondents stated that due to rain water harvesting there is an increase in groundwater level that is almost 100 percent of the respondents were responding positively, there is no negative response about increase in groundwater level by harvesting rain water. The study also find outs the ideas implemented to increase ground water level through rain water harvesting is that, 61 percent of the respondents were using the direct rain water runoff to ponds to recharge ground water level, 34 percent of the respondents were stored the rain water in the ponds near to borewell to refill the ground water level, 4 percent of the respondents were preserving the rain water near to wells to increase ground water level.

The also includes the details about the survey on improvement of ground water level through rain water harvesting and water resource management. All the respondent are responding positively about ground water improvement through rain water harvesting, and it also discuss the ideas implemented for recharging the ground water level is that they are mostly using the direct rain water runoff to ponds to recharge ground water level and by storing the rain water near to the wells and bore wells to get refilled.

CONCLUSION

Rain water harvesting and water resource management are discussed briefly in this study, and its also gives lots of information about rain water harvesting system and water resource management and techniques and technologies implemented for rain water harvesting

system and for water resource management. The study also gives the information about how much the respondents are benefited through rain water harvesting and water resource management. Its also gives the information about the benefits and sources of rain water harvesting. Rainwater is a source that if harnessed correctly, can provide a system of sustainable water to those where water isn't always readily available. It allows for full control of your own water supply for agricultural, home, and livestock purposes. The dry, wet, and barrel systems have different methods of capturing rain, but all include similar components: catchment, conveyance, storage, treatment, and distribution. Let's continue to educate each other on rainwater harvesting as a viable means of combating the global water crisis.

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QUESTIONARIE

Socio economic background of the beneficiaries

Section-A

1) Name of the Beneficiary

2) Address of the beneficiary

3) Contact number

4) Age in years

a) Above 20-30
b) Above 31-40
c) Above 41-50
d) Above 50

5) Educational Qualification

a) Below 12^{th}
b) 12^{th} std
c) Under graduate
d) Post graduate
e) Others

6) Gender

a) Female
b) Male
c) Others
d)

7) Where do you live in at the moment?

a) Urban area
b) Rural area

8) Type of family

a) Joint family
b) Nuclear family

9) Income level of the beneficiary per month?

a) Above Rs.5000
b) Rs.5001- Rs.10000
c) Rs.10001- Rs.15000
d) Rs.15001- Rs.20000
e) Above Rs.20000

10) Marital Status

a) Married
b) Unmarried

11) Income level of the family per month?

a) Below Rs.10000
b) Rs.10001- Rs.20000
c) Rs.20001- Rs.30000
d) Above Rs.30000

12) Occupation of the Respondent

Section-B

13) How do you know about rain water harvesting?

a) Through other beneficiaries

b) Through government announcement

c) Through Friends & relatives

d) Mass media

e) Others

14) Who will help you to implement this rain water harvesting?

a) Guidance by Government officials
b) Own willingness
c) Implemented through government schemes
d) Others

15)What is the storage capacity of rain water of the Tank?

a) Below Rs.50000
b) Rs.50000 - Rs.100000
c) Above Rs.100000

16) What are the technology used for building a storage tank? (mention what it is ?)hint

a) Traditional method
b) Jacking method
c) Tarpaulin method
d) Others

17) What are the techniques used to preserve a rain water?

a) Surface runoff harvesting

b) Rooftop rainwater harvesting

c) Building a rain saucer

d) Others

18) Is there any filtration technology used before preserving a rain water?

☐ Yes ☐ No

19) If, yes What it is?

a) Mechanical pre - tank filters
b) Microscopic filtration
c) Natural way of filtration

d) Others

20) How much it cost to build a storage tank?

a) Above 50000

b) 50001-100000

c) 1,00,000-2,00,000

d) above 200000

21) Are you benefited through any government schemes implemented for rain water harvesting system?

☐Yes ☐No

If yes,

a) “Jal Shakti Abhiyan:catch the Rain”-2021.

b) “Rain Water Harvesting Scheme” -2001.

c) Others

22) From where you get the awareness about Rain water harvesting scheme implemented by government?

a) Agricultural officers of our locality
b) Announcement by television
c) Mass media
d) Other beneficiaries near your locality
e) Others

23) How do you create a source for rain water harvesting?

a) Roof top rain water harvesting

b) Surface runoff harvesting

c) barrel saucer harvesting

d) Others

24) What is the preservation resource of rain water harvesting?

a) Store rain water in drums

b) Direct rain water runoff to RC tanks using pipes and settingbowls

c) Make a roof garden

d) Directed to borewell to get refilled

25) On what purpose do you use the harvested rain water?

a) Agricultural purposes

b) Water for wildlife, pets or livestock

c) Human consumption like drinking,cooking etc.,

d) Others

26) Is it the rain water harvesting is useful?

☐ Yes ☐ No

If yes,

a) Save money

b) Reduces water bills

c) More gardening facility

d) Others

27) Is there any benefits of processing rain water harvesting?

☐ Yes ☐ No

28) How long you preserve the rain water for usage?

a) 3 months

b) 3-6 months

c) 6-9 months

d) 9-12 months

e) More than one year

29) After harvesting is there any remedies to preserve the water?

☐ Yes ☐ No

30) If the rain water is used for agriculture purpose, how much it is benefited?

☐ Excellent ☐ Good ☐ Not bad

31) Is there any amount allocation for implementing rain water harvesting system by government?

☐ Yes ☐ No

32) If Yes, How much will be allocated?

a) 75% of estimated value

b) 50% of estimated value

c) 25% of estimated value

d) below 25%

33) Is that rain water harvesting increases ground water level?

☐ Yes ☐ No

34) Is there any idea implemented to increase ground water level through rain water harvesting?

a) Direct the rain water runoff to borewell to get refilled

b) Store the rain in the pond near to borewell to increases groundwater level

c) Preserve the rainwater near to wells to increases groundwater level

d) Others

35) Is that, there is any improvement in your income level after harvesting and usage of rain water?

☐ Yes ☐ No

If yes,How much it is ?

a) Rs.5000 to Rs.10000

b) Rs.10001 to Rs.15000

c) Rs. 15001 to Rs.20000

d) Above Rs. 20000

36) What type of crops cultivating using rain water ?

a) Rise

b) Pulses

c) Vegetables

d) Corn varieties

e) Others

37) What type of advantage to you get after harvesting rain water ?

a) Reduce water bills

b) Ecological benefits

c) Reduces erosion and flooding around buildings

d) Adequate means for irrigation purpose

e) Reduce demand on ground water

f) Others

38) Rain water harvesting is

☐ Good ☐ bad ☐ environmental friendly

39) Give your opinion about ground water level after harvesting rain water?

40) Mention your income level before and after rain water harvesting?

41) Are you using more than one source for harvesting rain water?

42) Are you having any idea to increase the storage level of harvested rain water?

ANNEXURE - II

INSTITUTIONAL HUMAN ETHICS COMMITTEE

Avinashilingam

Institute for Home Science and Higher Education for Women
(Deemed to be University under Category 'A' by MHRD, Estd. u/s 3 of UGC Act 1956) Re-accredited with 'A++' Grade by NAAC.
Recognised by UGC Under Section 12 B
Coimbatore-641 043, Tamil Nadu, India

18th April 2022

To
Ms. Selva Gayathri.M
Department of Home Science Extension Education
Avinashilingam Institute for Home Science and
Higher Education for Women
Coimbatore – 641 043

Dear Selva Gayathri.M,

Ref: Your proposal No. IHEC/21-22/EXT-12 entitled "A Study on Rain Water Harvesting and Water Resource Management in Selected Villages of Tirpur District" submitted for approval of IHEC on 23.11.2021.

The Institutional Human Ethics Committee of our University hereby grants approval to your research proposal No. IHEC/21-22/ EXT-12 entitled "A Study on Rain Water Harvesting and Water Resource Management in Selected Villages of Tirpur District" submitted by you. The Approval number for the same is AUW/IHEC/ EXT-21-22/XPD-12.

We wish you all the best in your research endeavours.

Regards,

S. Uma Mageshwari
Dr.S.Uma Mageshwari
Member Secretary

Institutional Human Ethics Committee