RESEARCH ARTICLE OPEN ACCESS

Rain Water Harvesting And Its Uses For Laboratory At Baif Central Research Station Campus

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I. BASICS OF RAINWATER HARVESTING

Introduction

Water is one of the most commonly used substances on our earth. We need water for all our activities in day-to-day life. Water supply in urban area is always short against the total demand. Surface water is inadequate to meet our demand and we have to depend on ground water. Due to rapid urbanization, infiltration of rainwater into the subsoil has decreased drastically and recharging of ground water has diminished. This scenario requires an alternative source to bridge the gap between demand and supply. Rainwater, which is easily available and is the purest form of water, would be an immediate source to augment the existing water supply by "catching water wherever it falls".

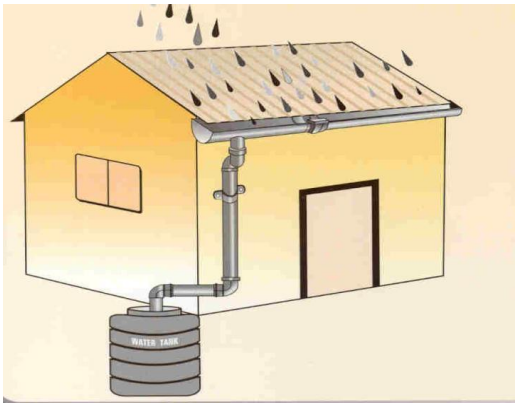
Rainwater Harvesting has emerged as a viable alternative to traditional perennial sources of water in hilly areas, in places where the level of fluoride and arsenic is above permissible limits and in urban areas facing water shortage and flooding during monsoons.

Rainwater Harvesting (RWH) is the process of collecting and storing rainwater in a scientific and controlled manner for future use. Rainwater harvesting in urban areas include

- Roof top rainwater harvesting
- Rainwater harvesting in paved and un-paved areas (open fields, parks, pavement landscapes etc.)
- Rainwater Harvesting in large areas with open ponds, lakes, tanks etc.

Benefits of Rainwater Harvesting

1. Environment friendly and easy approach for water requirements
2. RWH is an ideal solution for water requirements in areas having inadequate water resources
3. Increases ground water level
4. Improves ground water quality
5. Mitigates the effects of drought
6. Reduces the runoff, which otherwise flood storm water drains
7. Reduces flooding of roads and low-lying areas
8. Reduces soil erosion
9. Cost effective and easy to maintain
10. Reduces water and electricity bills



Rainwater Harvesting

- Traditional Water Harvesting in Karnataka underlines the importance of step wells, lakes, tanks, channels etc., as water storage bodies, the basic purpose of which was to establish a chain of water storage structures. However, a vanishing "Lake Culture" due to urbanization and industrialization has caused these systems to be neglected.
- To make Rainwater Harvesting (RWH) a success, we should have a thorough knowledge of the following: geographic location; climate; geology; soil; land use; water requirements; existing water supply system; cost of water; systems & forms of RWH and the potential of harvesting rainwater.
- RWH has the following unique advantages
  - Capturing rainwater in-situ and augmenting supply water at a marginal cost
  - Replenishing groundwater through recharging of rainwater by using the soil column
  - Reducing pollution and contamination

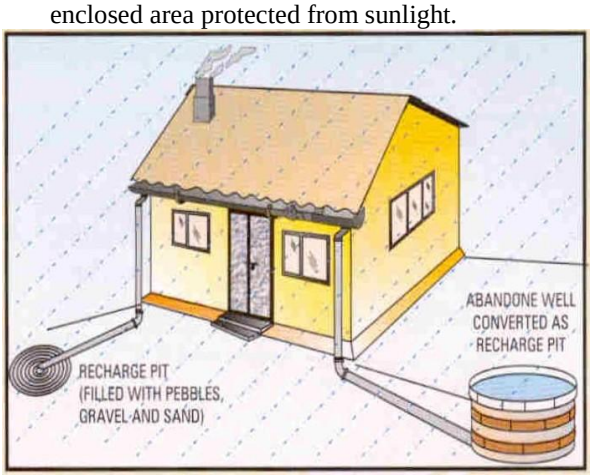
- Reducing the water bill for the state exchequer
- Providing clean and safe water
- Least capital investment with maximum benefits to households and the city as a whole
- The demerits of RWH
- It is dependent on the monsoons and intensity of rainfall.
- It depends on intensive participation from house level to the city level.
- It is only a supplementary source and cannot replace the existing supply system completely.

Quality of rainwater harvested

As the primary source of water, rainwater is the purest form of water. Rainwater harvesting not only solves the problem of availability of water, but also provides good quality water.

However, certain precautions need to be taken to ensure that the stored water is not polluted.

- Keep the roof or the water collection area clean before the rains.
- Flush the rainwater collected in the first few minutes.
- Store the collected rainwater in a closed container (avoid sunlight).
- The quality of water deteriorates in the presence of sunlight and air.
- Water can be kept clean over a period of five to six months in a clean container stored in an enclosed area protected from sunlight.



II. NEEDS FOR RAIN WATER HARVESTING AT BAIF CENTRAL RESEARCH STATION CAMPUS

The BAIF Central Research Campus Urulikanchan is situated 32 Km away from Pune. The campus area comes under drought prone region which is receiving very minimum rainfall .The annual average rainfall is 300 mm. The campus is having different research laboratories like semen freezing lab, molecular genetics lab, R.B.T lab, E.T. Lab. , Biofertilizer lab , these labs required water which is pyrogen free, heavy metals free and microbial load free ultra pure for their research and cryopreservation of semen doses. The required quality water is produced from the raw water from BAIF owned well of crs campus, which is having 1400 P.P.M. T.D.S and other heavy microbial count. This water is allowed to pass through R.O.Plant having (softener+filteration) system for making clean and soft then the water is allow to pass through MILLIPORE system for making it of required quality water.

As the raw water contains TDS that is four times more than permissible TDS the both R.O. Plant and MILLIPORE plants were having major repair and maintaince problems. The Engineer visits four to five times a year for doing repair and maintaince of plants. For which organization pay for his visit fees + cost of accessories required to be replaced. Sometimes we are not able to get his urgent services due to which we are not able to produce distilled water from the plant and required to be purchased at maximum rates from Pune.

III. COMPUTATION OF RAIN WATER QUANTITY

Rain water quantity available in one monsoon season Q liters = AX R X C

Where A= surface or terrace area in sq m

R= average rain fall intensity (mm) in one monsoon season

Usually in pune area R=600 MM (however it depends upon the the condition of the rain fall in that area)

C= Coefficient of Runoff =0.90

Rain water available in one rainy day can be calculated in a similar way in pune average daily rainfall is about 10 mm .hence value of R to be considered as 10 mm

Based on this formula approximate rainfall quantity can be computed as follows

Item	**Terrace area A in sq.m**	**Approximate rain water availability in one season**	**Approximate rain water availability in one season per day**	**Remark**
Biofertilizer unit	180 sq m	97200 liters	1620 liters	A.C. sheet roofing
Semen laboratory	65 sq m	35000 liters	585 liters	R.C.C. slab is used to harvest rainwater

Biofertilizer unit

- Capacity of underground water tank is 50000 liters
- Area of terrace = 180 sqm
- R= 600 mm (0.6 m)
- C= 0.9
- Type of roof – A.C.sheet roofing

- Approximate rain fall quantity = A*R*C
- Available in one season = 180 * 0.6 * 0.9
- = 97.2 cum
- = 97200 liters so the tank fills approximately two times during rainy seasons
- Rainfall availability per day = in one rainy day average rain fall is about 10 mm hence value of R to be considered as 10 mm
- Approximate rainfall quantity per day = A*R*C
- = 180 * 0.01* 0.9
- = 1.62 cum
- = 1620 liters

Semen Laboratory

- Capacity of ground water tank is 50000 liters
- Area of terrace = 65 sqm
- R= 600 mm (0.6 m)
- C= 0.9
- Type of roof – R.C.C. roofing

- Approximate rain fall quantity = A*R*C
- Available in one season = 65 * 0.6 * 0.9
- = 35.1 cum
- = 35,100 liters
- Rainfall availability per day = in one rainy day average rain fall is about 10 mm hence value of R to be considered as 10 mm
- Approximate rainfall quantity per day = A*R*C
- = 65 * 0.01* 0.9
- = 0.585 cum
- = 585 liters

Rain water harvesting system at Biofetilizer unit

Biofertilizer unit required more than 300 liters of distilled water per day during their seasonal activity for three months. The boiler of biofertilizer unit is having scaling problem due to hard water. For solving this problem it is decided to harvest the rain water and use as a raw water supply to boiler. The roof area of biofertilizer unit is Asbestos cement sheet of 180 sq m. From which we are able to harvest 97,000 liters of rain water .for this we plan to construct an underground water tank of 52000 liters.

Rain water harvesting system at semen lab

Semen lab daily required more than 100 liters of distilled water for their laboratory purpose. For which raw water passing through R.O.& MILLIQ plant will be used. As the harvested rain water is having hardness 100-120 PPM it is decided to harvest the semen lab roof water. The roof area of semen lab is 65 sqm. From which we are able to harvest 35000 liters of rainwater that is 585 liters of rain per day considering 10 mm per day rainfall in urulikanchan during rainy day .for harvesting the rainwater we use sintex water tank of capacity 22,000 liters in which they are having 5000liters 3 tanks , 2000 liters 3 tanks and 1000 liters one tank. The tanks are kept over platform above ground.

About system

A rainwater harvesting system developed by HYDRO-BIOTECH SYSTEMS was installed for harvesting rainwater. The rainwater from existing roof over biofertilizer unit is collected through PVC pipelines, which is then passed through sand filters having back washing systems. The filtered water is collected in underground water tank having total capacity of fifty two thousand liters. The tanks get filled two times for harvesting total rainfall during rainy days. The total system costs rupees 1,90,000=00 including cost of construction of underground water tank and rainwater harvesting system so the cost of rainwater harvesting system per liter is RS. 1.95 per liter. The market cost of distilled water is RS. 5.60/liter for purchasing it from market we have required RS. 1,12,000=00 which is more than the rain water harvesting system installed at semen lab.

Biofertilizer unit rain Water harvesting system

Rainwater harvesting tank & filter

Underground water tank with filter

Fermenter

Boiler

Open well of BAIF

Semen Lab

molecular Lab


Rain water harvesting Tank near Semen bank


Rain water harvesting tank filter


Sintex tank for rain water harvesting for semen lab

IV. CONCLUSION

- The maintaince and repairs of R.O. and MILLIQ plants reduced.
- The life of different parts of plants increased.
- The rainwater harvesting system is economical.
- The harvested rainwater is supplied to existing boiler of biofertilizer lab so scaling problem of boiler is reduced.
- The life of different parts of plants increased.
- The rainwater harvesting system is economical.
- The maintaince cost of R.O. and Milique plant reduced.

REFERENCES

[1] **B. K. Kakade Sep 2000, "**Community Water Supply and Watershed Development and Management: Indian Scenario"

[2] **B. K. Kakade et. al. "**Integration of Drinking Water within Watershed Development Programme" **Unpublished Report.**

[3] **B.K.Kakade " watershed Manual"**

RAIN WATER HARVESTING INSIDE THE CAMPUS CENTRAL RESEARCH FOUNDATION URULIKANCHAN

Needs For Rain Water Harvesting

The crs campus is situated 2.5 km away from Urulikanchan. The campus area comes under drought prone region receiving very minimum rainfall of annual average rainfall of 300 mm. The campus is having different research laboratories like semen freezing lab, molecular genetics lab, R.B.Tlab, E.T. Lab. these labs required water which is pyrogen free, heavy metals free and microbial load free ultra free pure for their research and cryoresearvation of semen doses. The required quality water is produced from the raw water from well no -1 of crs campus, which is having 1400 P.P.M. T.D.S and other heavy microbial count. This water is allowed to pass through R.O.Plant having (softener+filteration) system for making clean and soft then the water is allow to pass through MILLIPORE system for making it of required quality water.

As the raw water contains TDS that is four times more than permissible TDS the both R.O. Plant and MILLIPORE plants were having major repair and maintaince problems. The Engineer visits four to five times a year for for doing repair and maintaince of plants. For which organization pay for his visit fees + cost of accessories required to be replaced. Sometimes we are not able to get his urgent services due to which we are not able to produce distilled water from the plant and required to be purchased at maximum rates from Pune.

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Semen lab daily required more than 100 liters of distilled water for their laboratory purpose.

For which raw water passing through R.O.& MILLIQ plant will be used. As the harvested rain water is having hardness 100-120 PPM it is decided to harvest the semen lab roof water. The roof area of semen lab is 65 sqm. From which we are able to harvest 35000 liters of rainwater that is 585 liters of rain per day considering 10 mm per day rainfall in urulikanchan during rainy day.

About System

A rainwater harvesting system developed by HYDRO-BIOTECH SYSTEMS was installed for harvesting rainwater. The rainwater from existing RCC slab is collected through PVC pipelines, which is then passed through sand filters having back washing systems. The filtered water is collected in sintex tank having total capacity of nine thousands liters. The all tanks get filled three to four times for harvesting total rainfall during rainy days. The total system costs rupees 12,159=00 excluding the cost of existing sintex tanks available with us so the cost of rainwater harvesting system per liter is RS. 2.80. The market cost of distilled water is RS. 5.60/liter for purchasing it from market we have required RS. 1,96,000=00 which is more than the rain water harvesting system installed at semen lab.

Conclusion

- The maintaince and repairs of R.O. and MILLIQ plants reduced.
- The life of different parts of plants increased.
- The rainwater harvesting system is economical.

- **Rain water harvesting system at Biofetilizer unit**

Biofertilizer unit required more than 300 liters of distilled water per day during their seasonal activity for three months. The roof area of biofertilizer unit is 180 sqm. From which we are able to harvest 97,000 liters of rainwater.

About system

A rainwater harvesting system developed by HYDRO-BIOTECH SYSTEMS was installed for harvesting rainwater. The rainwater from existing roof over biofertilizer unit is collected through PVC pipelines, which is then passed through sand filters having back washing systems. The filtered water is collected in underground water tank having total capacity of fifty two thousand liters. The tanks get filled two times for harvesting total rainfall during rainy days. The total system costs rupees 1,90,000=00 including cost of construction of underground water tank and rainwater harvesting system so the cost of rainwater harvesting system per liter is RS. 1.95 per liter. The market cost of distilled water is RS. 5.60/liter for purchasing it from market we have required RS. 1,12,000=00 which is more than the rain water harvesting system installed at semen lab.

Conclusion

- The harvested rainwater is supplied to existing boiler of biofertilizer lab so scaling problem of boiler is reduced.
- The life of different parts of plants increased.
- The rainwater harvesting system is economical.
- The maintaince cost of R.O. and Milique plant reduced.

1. RAIN WATER HARVESTING SYSTEM AT CRS CAMPUS
2. NEEDS FOR RAIN WATER HARVESTING
A) LOCATION OF CRS CAMPUS
B) ANNUAL AVERAGE RAINFALL
C) RESEARCH LABORATORIES AT CAMPUS
D) EXISTING SOURCE OF WATER AND ITS TDS CONTENT
E) EXISTING WATER PURIFICATION SYSTEM AND ITS PROBLEM

3 RAIN WATER HARVESTING SYSTEM AT SEMEN LAB

4 ABOUT SYSTEM
A) NAME OF AGENCY
B) INSTALLATION COST
C) ECONOMY
D) BENEFITS OF RAIN WATERSYSTEM OBSERVED
5 RAIN WATER HARVESTING SYSTEM AT BIOFERTILIZER
6 ABOUT SYSTEM
E) NAME OF AGENCY
F) INSTALLATION COST
G) ECONOMY
H) BENEFITS OF RAIN WATERSYSTEM OBSERVED

1 PERCOLATION TANK AT CRS
2 NEEDS FOR HARVESTING WATER ATCRS CAMPUS
A) LOCATION , DETAILS ABOUT AREA , RAINFALL

3 ABOUT CONSTRUCTION OF PERCOLATION TANK

4 DETAILS REGARDING PERCOLATION TANK
A) YEAR OF CONSTRUCTION - 1999
B) SIZE OF TANK - 200' X150' X 10'

C) FERTILE SOIL RECEIVED FROM TANK -3000BRASS
D) CAPASITY OF TANK - 84,00000 LITERS
E) TOTAL EXPENDITURE - RS / 1,50,000
F) TOTAL LAND DEVELOPED - 4 ACRE
G) NET YIELD RECEIVED FROM 4 ACRE LAND IN FIRST YEAR - MAZE - 50 TONE , JOWAR - 20 TONE , OAT - 20 TONE
H) NET INCOME FROM CROP AND FISH SELLING-
MAZE 50 TONE X 1000 RS / TONE - 50,000
JOWAR 20 TONE X 800 RS / TONE - 16000
OAT 20 TONE X 1000 RS / TONE - 20,000
FISH SELLING APPROXIMATELY - 25000
NET TOTAL INCOME PER YEAR - RS/1,10,000

5 CONCLUSION -

A) 4 ACRE LAND DEVELOPED
B) STORED WATER WILL HELP IN FISHERY , IRRICATION OF CROPS IN CAMPUS AND NEARBY BOREWELL GETS RECHRGED
C) THE COST OF CONSTRUCTION OF TANK IS RECOVERED WITH IN FIRST OR SECOND YEAR
D) PURCHASING FODDER FROM OUT SIDERES STOPPED SAVING RS / 86,000 PER YEAR

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