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"Creating Farmer Friendly Knowledge Package for Implementation of Bhungroo Technology for the Agriculture"

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ABSTRACT

Artificial recharge is a technique which is used to recharge underground aquifers or to increase water table level of the area. The reason to invent such technologies is increased use of underground water, which result in decrease of ground water table level. There are many methods of artificial recharge which help in aquifer or increase in ground water table but did not provide water for irrigation purpose but here is one technology called Bhungroo Irrigation Technology (BIT) provides water for irrigation purpose in post monsoon season. Bhungroo uses excess rainfall runoff and store it underground by the means of borehole. As water is stored underground it free from evaporation losses and pollution. There are many Bhungroo installed all over India and they are working successfully and effectively. This paper represent information about the installed Bhungroo in Maharashtra, India. It consist details of site, filtration media, storage capacity, irrigation of farm and drilling.

Keywords – Artificial recharge, Ground water table, Irrigation, Bhungroo Irrigation technology (BIT), filtration media, Post monsoon season.

INTRODUCTION

The artificial recharge to ground water is mainly done to recharge the ground waterreservoir by changing/modifying the natural movement of surface water with help of civil construction techniques. Artificial recharge techniques normally done to,[1]

1. To increase the storage capacity of areas where over-development has reduced theaquifer storage.
2. Conservation and storage of excess rainfall runoff for future requirements.
3. To improve the quality of ground water.

Artificial recharge techniques mainly help to increase ground water table. This will provide water for the drinking purpose or other generalpurpose but not for irrigation purpose in dry season/post monsoon season. Where Bhungroo is mainly working on providing water for irrigation purpose in dry period and free waterlogged areas. Bhungroo helps farmers to save their lands from waterlog and gives water to cultivate more crops in post monsoon season. Bhungroo uses extra rainfall runoff water which is not used for cultivation. The

reason behind Bhungroo's success is that each monsoon season it is refiled with rainwater due which drying of borehole is very rare. Bhungroo have low maintenance cost, one time investment and life span of 30 years.

This technology is invented by Mr. Biplab Paul who is director of Naireeta Services Pvt. Ltd. (NSPL). They installed many Bhungroo all over India and outside of India. They installed one Bhungroo unit in Khamgoan, Taluka – Phulambri, District – Aurangabad of Maharashtra state. The details of this Bhungroo are presented in this paper.

1. ABOUT THE BHUNGROO

Bhungroo, which means 'straw' or 'hollow pipe' in Gujarati, is an ingenious handmade pipe that enables excess rainwater to be filtered and stored underground to prevent flash flooding and waterlogging of crops. In drier periods, the collected water can be withdrawn and used to prevent crop failures caused by drought.

Bhungroo has the potential to ensure food security for millions of people across the world, and Trupti and Biplab are committed to sharing the technology through an open source model and encouraging co-creation models. Naireeta Services has partnered with governments and NGOs across south and southeast Asia – through these partnerships, their technology currently benefits farmers in Bangladesh, Burma/Myanmar, Cambodia, Laos, Pakistan, Sri Lanka, andVietnam. Further afield, more than 100 ultra-poor women smallholders in Ghana are benefiting from Bhungroo technology, through replication by partner organizations including Feed the Future (the US Government's global hunger and food security initiative).

In 2007, Bhungroo was awarded the World Bank's India Development Marketplace Award for best innovative technology for social inclusion, and in 2014 it secured the UNFCCC's (United Nations Framework Convention on Climate Change) prestigious Momentum for Change Award. In 2017, Trupti received a Cartier Women's Initiative Award for her work. [2]

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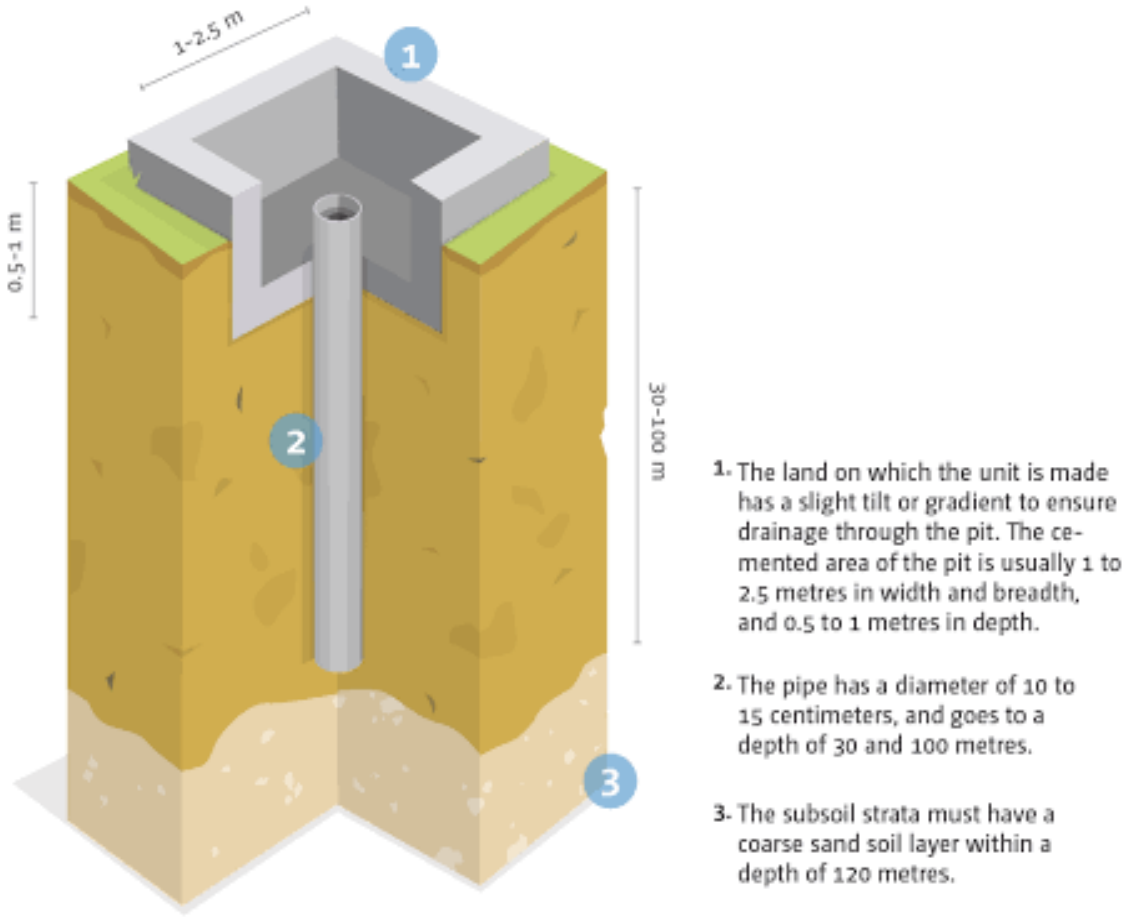

Fig. No. 1 – Bhungroo Irrigation Technology

2. SITE DETAILS

In Maharashtra Bhungroo is installed in Aurangabad district village Khamgoan. Which is come under Phulambri tehsil and 45km away from Aurangabad city. This site is financially supported by the 'Dilasa Agro Processors Pvt. Ltd.' and 'Mahindra rise'. Location of Bhungroo is outside of village and installed on the bed of small stream, which is generally active in monsoon season. The Location co-ordinates of Bhungroo are 20°12'14.98"N ; 75°30'33.65"E. This Bhungroo is installed by the Naireeta Services Pvt. Ltd. in April, 2015. The details of owner are as per follow,

Name – Shravan Rangnath Sonavane.

Address – A/P Khamgoan, Tal. – Phulambri, Dist. – Sangli.

Mobile No. – 9860761071

Land – 5 acres

Crops– Maize, cotton, Ginger, coconut, mango and lemon.

Crops per year – 3 crops per year

Image No. 1 – Name Plate

Image No. 2 – Bhungroo Unit

3. FILTRATION MEDIA

In Bhungroo technology rainwater is stored under the ground and it requires to filter before send it to the underground aquifer. This is has to done to avoid aquifer pollution and chocking of borehole through which it transfer to underground aquifer. The filtration media is made as per CGWB norms and with little modification to it. Filtration media is mainly consist of sand, gravel, crush sand, charcoal, stones etc. The Aurangabad site consist of following Martials,

1. Crush sand
2. (3/4)" gravel
3. 40mm – 60mm stones
4. Daber stone

Size of filtration media is vary from 1m x 1m x 1m to as per ground condition. Bigger is the size of media more of water can be stored for long period as filtration rate is lower. Also it will help in to maintain more height of water above borehole. Which make hydrological pressure helpful for better filtration rate.

Aurangabad site filtration media details as per follow,

1. Size – Outer dimension 50ft. x 50ft. x 15ft. and inner filter media dimension 10ft. x 10ft. x 6ft.

2. Pitching of filtration pit is done with daber stones.
3. Depth of various filtration media layer is 1ft to 1.5ft.
4. 72 micron steel mesh is used to roll over casing pipe. This will help in to avoid entry of sand inside the borehole.
5. Casing pipe diameter is 8 inch and having holes drilled by drill machine.

Image No. 3 –Construction of filtration Chamber

Image No. 4 – Filtration Chamber

4. STORAGE CAPACITY

Bhungroo storage capacity depend upon the underground aquifer, catchment area, water source and dry zone. This dry zone is located by the geophysical survey of that area. Average storage capacity of Bhungroo is 4 lakh liters according to NSPL. Following are the details of about storage capacity of Aurangabad site,

1. Monthly rainfall details of Aurangabad district for the year 2017 [3]

Table No. 1 – Aurangabad district monthly rainfall data in m

Year	May	June	July	August	September	October
2017	0.0013	137.6	79.8	157.2	176.9	105.3

2. Depth of borehole is 900ft.
    - For 1st 50ft there is black stone
    - For next 50ft there is dry zone
3. To collect rainwater from 10 acres of catchment area, existing stream is modified such way that maximum of can be collected. Also from 10 acres of land all the runoff is diverted towards the stream with help of trenches.

4.1 Runoff calculation

4.1.1 Formula

Runoff of that area is calculated with help of coefficients methods [1].

$$R = KP$$

Where, R – Runoff in meter

K – Runoff coefficient

P – Rainfall in meter

From table no. 2, value of K is,

As the Aurangabad site area is come under cultivation land it is take as farm from the table. The value for K for farm is 0.05 – 0.3, so the average of it 0.175is taken for the runoff calculation.

Table No. 2 – Values of Runoff Coefficient.

Type of Area	**Values of K**
Urban Residential	0.3 – 0.5
Forest	0.05 – 0.2
Commercial and Industrial	0.9
Parks, farms, pastures	0.05 – 0.3
Asphalt or concrete pavement	0.85

4.1.2 Catchment area

Rainwater is collected from the total area of 10 acres.

4.1.3 Calculations

1. **May month runoff**

R = KP

R = 0.175 x 0.0013

R = 0.000225 m

Storage = runoff x catchment

= 0.0002275 m x 40468.564 m^2

= 9.206 m^3

= 9206 liters

2. **June month runoff**

R = KP

R = 0.175 x 0.1376

R = 0.02408 m

Storage = runoff x catchment

= 0.02408 m x 40468.564 m^2

= 974.483 m^3

= 9,74,483 lite

3. **July month runoff**

R = KP

R = 0.175 x 0.0798

R = 0.013965

Storage = runoff x catchment

= 0.013965 m x 40468.564 m^2

= 564.536 m^3

= 5,64,536 liters

4. **August month runoff**

R = KP

R = 0.175 x 0.1572

R = 0.02751 m

Storage = runoff x catchment

= 0.02751 m x 40468.564 m^2

= 1113.290 m^3

= 11,13,290 liters

5. **September month runoff**

R = KP

R = 0.175 x 0.1769

R = 0.03095 m

Storage = runoff x catchment

= 0.03095 m x 40468.564 m^2

= 1252.502 m^3

= 12,52,502 liters

6. **October month runoff**

R = KP

R = 0.175 x 0.1053

R = 0.01842 m

Storage = runoff x catchment

= 0.01842 m x 40468.564 m^2

= 745.430 m^3

= 7,45,430 liters

Now, consider 30% are the losses like evaporation, infiltration etc. and 70% is the runoff which goes inside the Bhungroo.

Therefore,

Total runoff = Runoff of (May + June + July + August + September + October)

= 46,59,447 liters

Final Storage = 70% of total runoff

= (70/100) x 4659447

= 32,61,612 liters

From above calculation it is clear that about 32 lakh liters of water can be collected to store it in Aurangabad Bhungroo. According to NSPL the actual storage capacity of this Bhungroo unit is up to 25 lakh liters of water. It shows that even though upcoming monsoon season if rainfall is not sufficient then also Mr. Sonavane have enough water to cultivate one crop in post monsoon season and other use of it.

Image No. 5 – Bhungroo during dry season

Image No. 6 – Bhungroo during rainy season

5. IRRIGATION OF FARM

Irrigation of farm is done by various ways it can be done by traditional way i.e. by small trenches or by drip and sprinkle way. It depend upon financial condition of farmer. Mostly farmers have to go with drip or sprinkle irrigation because Bhungroo is more efficient with it. Irrigation details of Aurangabad site,

1. Total land irrigated by the Bhungroo is 5 acres.
2. Irrigation system used by the farmer Shravan Sonavane is drip irrigation.
3. Crops cultivated by the farmers are maize, cotton, coconut, lemon, mango and ginger.
4. For pumping out water from Bhungroo he uses 5 HP electric motor.
5. For 5 acre farm he spent 2lakh rupees on drip irrigation.
6. Shravan Sonavane before Bhungroo is unable to cultivate more than 1 crop per year because of scarcity of water. After Bhungroo he got enough water to cultivate two more crops in a year. Which increases his annual income from 1 lakh to 4 lakh plus, i.e. triple his income.
7. Crop production difference

Table No. 3 – Crop Production Difference

Crop Type	Before Bhungroo	After Bhungroo	Increase in crop production
Cotton	6 to 7 quintal	12 to 15+ quintal	6 to 8 quintal
Maize	15 to 20 quintal	30 to 35+ quintal	15 to 17 quintal

In short Bhungroo help him to doubles its crop production and cultivate 3 crops per year.

Image No. 7 – Drip irrigation system

Image No. 8 – 5HP electric pump

6. DRILLING DETAILS

- Type of drill used at Aurangabad site is rotary drill.
- For 300ft diameter of borehole is 8 inch.
- For 300ft to 900ft diameter of borehole is 6 inch.
- Casing for borehole is up to 5ft.

7. CONCLUSION

Bhungroo works on an environmentally-friendly and sustainable technology that can work lifelong. Once erected, each unit of Bhungroo, with a life span of 30 years, frees 5-10 acres of land from water logging each monsoon, and also gives water for irrigation to this 5 to 10 acres of land in winter and summer season.In each monsoon season, excess runoff water is being injected inside subsurface unsaturated zones by Bhungroo whereas average drafting is very less. Hence, it prevents overexploitation of subsoil aquifer.

Following are the things which made differencedue to Bhungroo,

1. Irrigated land before Bhungroo is not more than 1 acres after post monsoon season and after Bhungroo farmer cultivate his all 5 acres of land in post monsoon season.
2. Before Bhungroo all excess rainwater is which is stay in farm is removed and drained out. But after Bhungroo farmer tries to collect as much as rainwater and try to send it in Bhungroo.
3. Bhungroo solves farmer's water problem and provide water for land irrigation due which farmer is able to cultivate ginger, maize, cotton and fruits like mango, coconut and lemon.
4. Bhungroo helps farmer to triple its annual income from 1 lakh to 4 lakh plus.

5. After Bhungroo installation farmer is able to cultivate 3 crops per year with more production.

Table No. 4 – Crop production details

	Before Bhungroo	After Bhungroo
Cotton	6 to 7 quintal	12 to 15+ quintal
Maize	15 to 20 quintal	30 to 35+ quintal

6. Farmer recovered all his investment spent on Bhungroo irrigation within 2 years and now he is in full profit. Maintenance cost is also very low i.e. negligiblebecause cleaning of filter media can be done by farmer on his own.

Image No. 9 – Cultivated crop using Bhungroo water

Image No. 10 – Old house of owner

Image No. 11 – New house of owner

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