

RAINWATER HARVESTING: SOLUTION FOR IRRIGATION IN SALINE REGION OF WESTERN VIDARBHA

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ABSTRACT

The term water harvesting was probably used first by Geddes of the University of Sydney. He defined as the collection and storage of any form of water either runoff or creek flow for irrigation use. Nowadays water harvesting has become a general term for collecting and storing runoff water or creek flow, resulting from the rain in soil profile and reservoirs both over surface /under surface. In India, water harvesting means utilizing the erratic monsoon rain for raising good crops in dry tracks and conserve the excess runoff water for drinking and recharging purposes.

Rainfall is a basic resource for all the forms of water in Saline Region of western Vidharbha. Though the annual average rainfall of the country is 1200 mm, it varies in both space and time affecting the availability of water for different sectors. India uses 80% of the available water in agriculture keeping the remaining 20% for drinking, industry and energy sectors.

The present study was undertaken to quantify evaporation losses and seepage losses (storage losses) from dugout type farm ponds in saline tract area and to study the utility of harvested water on farmers' field. The average water storage loss in unlined farm ponds constructed in clay soils was found to be 125.66 cm. which comes to 18.60 per cent water storage loss during five-month of storage period. Thus, nearly 1100 m³ harvested rainwater will be available for use in rainfed areas from 2 ha. Catchment area up to February and later on groundwater resources can be tapped during the summer period for improving the production potential of crops and its sustenance in Vidharbha.

Keywords: Farm pond, Water harvesting and Recycling, Saline area, Evaporation, Storage capacity.

1. INTRODUCTION:

Water is essential for all life and used in many different ways, It is also a part of the larger ecosystem in which the reproduction of the biodiversity depends. Freshwater scarcity is not limited to the arid climate regions only, but in areas, with a good supply, the access of safe water is becoming a critical problem. Lack of water is caused by low-water storage capacity, low infiltration, larger interannual and annual fluctuations of precipitation.

India has an ancient history of tank technology. Runoff collection ponds exist in nearly every district in India. Runoff collection irrigation tanks are more concentrated in coastal districts of Tamil Nadu and Andhra Pradesh (Telangana), south-central Karnataka, and east Vidarbha in Maharashtra state. "A Tank Irrigation Authority" is created to manage all aspects of tank irrigation by Government of India. Irrigation has great importance in agriculture. In India total cultivable land is 139.36 M ha, out of this 37.64 M ha is under irrigation which comes to 27 per cent. In Maharashtra, the total cultivable land is 18.5 M ha and the gross cropped area is 22.66 M ha out of which 4.04 M ha is the gross irrigated area and the percentage of gross irrigated area to gross cropped area comes as 17.8 (Anonymous,2009), which is quite below the national average of 27 per cent.

The farm pond is the most common technique of rainwater harvesting and recycling for saline tract area. Harvesting of rainwater and reusing it for sustainable agriculture in rainfed areas an urgent need of in Vidharbha region under changing rainfall situation since groundwater resources are fast depleting. Hence for improving the production potential of crops and its substances in the semi-arid region under erratic monsoon rainfall years, conjunctive utilization of surface water resources along with groundwater resources is unavoidable The farming practices adopted in a saline tract of western Vidarbha is rainfed since groundwater resources are not suitable for irrigation. The productivity in this area is dependent on the amount and distribution of monsoon rainfall. Harvesting of rainwater and reusing it for providing life-saving irrigation to crops has thus become an urgent need of the hour for stabilizing and further improving the production potential of dryland farming in the saline tract for the benefit of farmers under ongoing changing rainfall situation and recurring droughts.

To overcome the drought-prone situation in drought-affected districts of western Vidarbha, constructions of several dugout type ponds (water storage structures) for the harvesting of excess rainwater on

farmers field is the best option available and is being implemented since last three years. Water stored in the ponds or reservoirs is subjected to loss by seepage and evaporation. The loss due to seepage is governed by the properties of soil-forming the floor and the banks of the storage while evaporation loss is a function of the climate characteristics of the location of the storage. The availability of harvested water in the rabi season depends on storage losses from farm ponds and information on this aspect in saline tract region of western Vidarbha is not available. The present study was undertaken to quantify evaporation losses and seepage losses (storage losses) from dugout type farm ponds in saline tract area and to study the utility of harvested water on farmers' field.

2. STUDY AREA:

The Ghussar village in Akola taluka is selected as an experimental site for the present study, since, a large number of dugout farm ponds are constructed during 2008 summer under Prime Minister package programme for drought-affected districts in Vidarbha region and few of them which were constructed under National Horticulture Mission had polyethylene linings so that the objectives of this study can be studied. It is located at $20^{\circ} 7'N$ latitude, $77^{\circ} 07' E$ longitude and

an altitude of 282 m above mean sea level. This Ghussar village comes under saline tract area of western Vidarbha. The soils are mainly black cotton soils with depth varying from 4 m to 10 m having clayey texture. They are poorly drained and have moderately high runoff potential.

The climate is characterized by relatively hot summer and cold winter. In Akola taluka average annual temperature ranges from a high of $48^{\circ}C$ to a low of $10^{\circ}C$. The overall climate can be classified as semi-arid tropical. The total average annual rainfall in Akola taluka is 751.52 mm. The village under the study received 655.9 mm annual rainfall during 2009 in 35 rainy days, out of which monsoon season (June to September) contributed 87 per cent.

3. DATA ACQUISITION:

There are about 120 dugout farm ponds constructed under the Prime minister Package and National Horticulture Mission Programme in Ghussar village of Akola taluka. During 2008-09 and 2009-2010, during 2008-09, only 27 ponds were constructed on farmers field while 93 farm ponds were constructed during 2009-10 under both the programmes as stated above. were only considered for this study and from which 05 dugout type ponds were selected for the study.

Sr. No.	Name of Farmers	Pond Number	Location of Farm Pond	Size of Farm Pond (m)
1	Shivprasad S. Laharia	1	32	30 x 30 x3
2	Sardar S. Laharia	2	33	30 x 30 x3
3	Rajesh S. Laharia	3	37	30 x 30 x3
4	Nilesh Raut	4	138	30 x 30 x3
5	Dipak Prakash Raut	5	137	30 x3

3.1. CLIMATIC DATA:

The climatic weather data on the minimum and maximum temperature, morning and evening relative humidity, bright sunshine hours, wind speed, pan evaporation and rainfall collected at Meteorological observatory of Agronomy Department, Dr Panjabrao Deshmukh Krishi Vidyapeeth,

Akola and was considered for the study. Since the experimental site is 12 km away from the location of the observatory.

4. RESULTS:

The result of "Rain Water Harvesting and Recycling for Farm pond in Saline Tract Area of western Vidharbha" The field data collected in respect of the storage losses from the experimental farm ponds and utility of harvested water during 2009 were analyzed losses. The results of the analysis are presented in the following heads.

4.1. Water storage losses from unlined dug out farm pond

The water storage loss (cm) from unlined dugout type farm ponds 30 m x 30 m x 3 m size recorded at five different locations during 2009.

Met Week	Dates	FP-1	FP-2	FP-3	FP-4	FP-5	Avg
40	1-7 Oct	0.00	0.00	0.00	0.00	0.00	0.00
41	8-14	7.08	6.93	6.60	6.00	7.08	6.74
42	15-21	6.89	6.52	6.50	6.00	7.00	6.58
43	22-28	7.10	6.69	6.70	6.00	7.10	6.72
44	29-4 Nov	6.17	6.40	6.40	6.00	6.17	6.23
45	5-11	5.78	6.29	6.29	5.50	6.00	5.97
46	12-18	5.88	6.27	6.27	5.00	6.00	5.88
47	19-25	5.97	6.19	6.19	5.16	6.00	5.90
48	26-2 Dec	6.11	6.17	6.17	5.66	6.00	6.02
49	3-9	6.84	6.03	6.03	5.67	5.67	6.05

Met Week	Dates	FP-1	FP-2	FP-3	FP-4	FP-5	Avg
50	10-16	6.81	6.04	6.03	5.33	5.33	5.91
51	17-23	6.79	6.04	6.04	5.34	6.65	6.17
52	24-31	6.77	6.07	6.07	5.33	6.69	6.18
1	1-7 Jan	6.65	5.90	6.80	5.67	6.72	6.35
2	8-14	6.69	5.90	6.90	5.00	6.75	6.25
3	15-21	6.72	5.91	6.00	5.33	4.33	5.66
4	22-28	6.75	5.92	6.50	5.67	5.67	6.10
5	29-4 Feb	6.90	6.16	6.21	5.67	5.67	6.12
6	5-11	6.90	6.23	6.22	5.67	5.67	6.14
7	12-18	6.93	6.09	6.00	6.01	6.01	6.21
8	19-25	6.61	6.00	6.00	5.26	5.26	5.83
Total		139.20	130.18	125.91	111.26	121.74	125.66

FP- Farm pond Number

4.2. Water losses from unlined farm ponds 2009

The volume of water lost due to evaporation in lined ponds and due to both evaporation and seepage in unlined ponds during the study period is given in Table 8.

The water storage capacity of dugout type farm ponds was calculated in Table 4.8, by using the Prismoidal formula (Gurmel Singh, 2004).

$$\text{Water storage capacity (V)} = \frac{A + 4B + C}{6} \times D$$

Where,

V = Volume of water in farm ponds (m³)

A = Top surface area of farm ponds in (m²)

B = Middle surface area of farm ponds in (m²)

C = Bottom surface area of farm ponds in (m²)

D = Depth of farm ponds in (m)

Table 4.1: Water losses from unlined dug out farm ponds in Five month storage period

Sr No.	Farm Pond Number	Size of Farm pond (m)	Total Storage Volume (m ³)	The volume of water loss (m ³)	Per cent Storage losses
1	1	30x 30 x 3	1971.00	384.84	19.53
2	2	30x 30 x 3	1971.00	352.21	22.21
3	3	30x 30 x 3	1971.00	295.81	18.27
4	4	30x 30 x 3	1971.00	250.07	14.93
5	5	30x 30 x 3	1971.00	290.81	18.07
Average water loss in Unlined farm pond (m ³)					18.60

The per cent of the volume of water lost from the farm ponds during October to February over the total storage capacity, in unlined ponds varies in the range of 14.93 to 22.21 per cent indicates that the average volume of water lost during Five months storage period (in unlined farm ponds comes out to be 18.60 per cent. There it can be concluded that in saline tract area or deep layer soils, on an average 18.60 per cent of the stored volume of harvested water is lost till its utilization as protective irrigation.

5. SUMMARY AND CONCLUSION :

The observations and the results of the study show that farm pond is an effective technology for harvesting and recharging the runoff thereby providing water for protective irrigation. From the results obtained in the present study, the following conclusions are drawn.

- The water storage losses from unlined dugout type farm ponds with an embankment on all the four sides were found to be varying from 111.26 cm to 139.20 cm during five months of storage period.
- The average water storage loss in unlined farm ponds constructed in clayey soils was found to be 125.66 cm.
- The per cent of the volume of water lost from the farm ponds during October to February over the total storage capacity, in unlined ponds varies in the range of 14.93 to 22.21 per cent indicates that the average volume of water lost during Five months storage period in unlined farm ponds comes out to be 18.60 per cent.

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