



## Rain Water Harvesting

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### Abstract

This article discuss the farm pond intervention in order to mitigate the water crisis in Rajasthan. Rajasthan is one of the largest states of India, covering nearly 10.4 percent of India's geographical area. The state is divided into 33 administrative districts and 10 agro-climatic regions. Over 65% of the cultivated area is rainfed and nearly 60% of the area falls under a desert environment. Nearly, two thirds of the population of about 6 crores depend for their livelihood on agriculture and animal husbandry, agro-forestry and agri-business. The average annual rainfall is 557 mm and there is a considerable degree of variation between seasons and regions within the state. Groundwater is getting both depleted and polluted. The economic well-being of a vast majority of the population depends heavily on the progress in agriculture. Climate of the state is mostly arid to semiarid with high annual evaporation rate. The rainfall is highly variable, irregular & erratic in nature. The monsoon season is between July to September. Maximum summer temperature ranges between 48°C to 17°C and minimum winter temperature ranges 32°C to 4°C.

### Water crisis in Rajasthan

Rajasthan has limited water resources 1.15 of the country. Groundwater resource is highly depleted and the state has 50% of fluoride-affected villages in the country are in Rajasthan. Groundwater is saline to highly saline in most western districts. In the state, the average annual rainfall is 557 mm and with a total area of 342239 sq. km, with valuable source of water. Rains are the main source of fresh water but generally stored runoff water and groundwater are considered as major sources of water for agriculture. There has been a number of initiatives undertaken by the state government as well as NGOs in the rainwater conservation and management in the state.

The small and the marginal farmers are the most affected segment. These segments of farmers also don't have the potential of having life saving irrigation facilities. For them, the initiative of farm ponds has been a boon. Farm ponds have been found to be the best way of coping with the distress condition in the region. Farm ponds are not only cost effective for small and marginal farmers, but have also provided the support of life saving irrigation.

### Farm Ponds

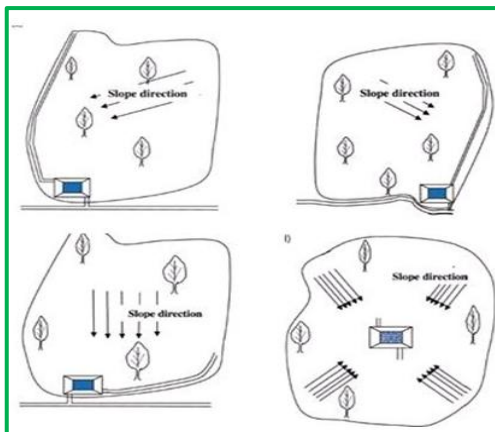
Farm ponds are rainwater storing structures made by constructing a dam or an embankment or by excavating a pit or dugout. The soil extracted from farm pond during the digging process is used to strengthen the embankment of the farm field. The water stored in the farm pond is used as critical life saving irrigation. This also ensures the availability of drinking water for animals.

Farm ponds are artificial depressions constructed at the lowest portion of a agricultural field primarily to provide protective irrigation.

**Types of Farm Ponds :-** Broadly farm ponds can be categorized into two types

1. **Embankment Type:** These type farm ponds are constructed across the stream or water course and consist of an earthen dam. Dimension of embankment are determined based on the required storage. These ponds are suitable for areas having gentle to moderately steep slope and also where stream valleys are sufficiently depressed to permit a maximum storage volume with least earth work.

2. **Excavated or Dugout Ponds:** These types of farm ponds are small dug out structures with well-defined shape and size. These structures have provision for inlet and outlet. Farm ponds are constructed at lower portion of the farm and generally stored water is used for irrigation. In some places farm ponds are used for recharging groundwater. However, for recharging groundwater, high capacity structures located in the highly permeable soil are more suitable. These structures are also called percolation tank



### Purpose

1. To store run off from farm field in which it is located.
2. To provide protective irrigation to the same field.

### Suitable Location

1. At the lowest portion of a field where run off gets collected.
2. Most suitable for rolling slopes but can be adopted in higher slopes also.

### The impact of farm ponds have yielded several benefits such as:

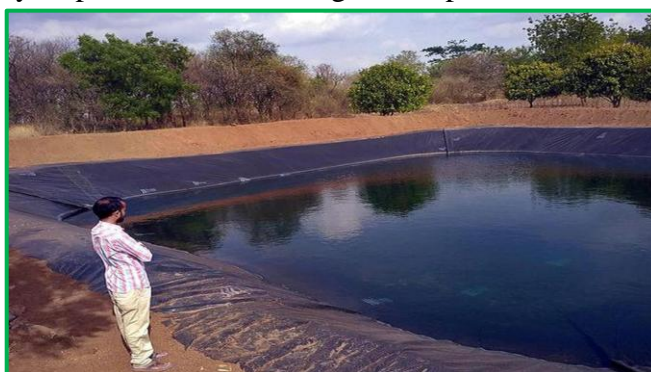
- Crop production even under terminal drought.
- Checks soil erosion and retains silt.
- Increased moisture content in the field.
- Prevents excess runoff from the field
- Availability of drinking water for the livestock.

### Design Criteria of Farm Ponds

1. The farm ponds are designed on the basis of rainfall in a particular area. If the annual rainfall is more than 1000mm, only 5% of the area is required for farm pond including the pond bund.
2. The depth of farm pond should be at least 2m and may go up to 3m.
3. For an area of about 4000 sqm, a farm pond has a capacity of about 300 cum. If full, this can provide 7.5 cm of irrigation to the same field.
4. Ideally the ponds needs to be dug step by step as shown in the figure. Steps of about 0.3m are made so that the slopes remain stable and calculation of earthwork is also simple.

### Benefits of Farm Ponds

- Farm ponds collects water from the field received during the time when crop does not require irrigation. This is lifted to irrigate the same field at the time when crops actually requires water and there is no rains. Thus it provides



protective irrigation during monsoon.

- If the collected water is not used in kharif season, this is used for additional irrigation for rabi crops.
- The water that gets collected slowly but steady infiltrates into the ground and recharges the ground water.
- If the farm ponds are constructed near an open well, it gets recharged.

### **Limitations to Farm Ponds**

1. Farm ponds are designed to collect water from a particular field. If the catchment area increases many fold, and if the rainfall is above average, there are chances of its erosion.
2. About 5-10% of the agricultural area is lost because of this and if the rainfall is good and in time, this loss is felt by the farmers.

### **Lining materials**

Lining material is necessary where the infiltration rate of soil is more than 10mm. The article easily adaptable various types of lining materials like clay, soil cement, concrete, chemicals like bentonite, Sodium bicarbonate, polymers like HDPE, LDPE, Silpoulin, LLDPE etc. and their major site specific annotations.

### **Effect of lining materials**

Clay lining: Excessive seepage in alfisols and luvisols can be abridged through clay lining where as in vertisols soil compaction can reduce seepage losses. Impounding area should be compacted proportionately for two to three times and well graded material containing at least 20% clay can be applied evenly. Clay lining is the cost effective compared to plastic membrane, biocrete and concrete lining (Jayanthi et al., (2004). Thickness of the blanket varies from 10 to 30cm depending on the depth of water impounding and type of soil.

### **Soil cement**

Is a highly compacted mixture of natural soil/ aggregate and portland cement, the soil material can be in any combination of sand, silt, clay and gravel which is readily available. Soil cement is a mixture of portland cement and natural soil. For best results the soil should be graded with a maximum size of 3/4th inch and contains 10 to 35% fines passing the No. 200 sieve (Bureau of reclamation). Depending on the depth of water stored, thickness of the lining material is fixed as 4" for water depth up to 8 feet and 6" for water depth up to 12 feet. Runoff water stored in farm pond used to irrigate kharif crop during dry spells and for rabi crop production On an average 93.5% seepage is reduced with 4.9 l/m<sup>2</sup> /day. Though the seepage losses from the lined pond are increasing year after year it can be adapted where the budget is a constraint.

### **Polymer lining**

Waterproof lining material for pond are polyethylene, vinyl, butyl rubber and asphalt sealed liners are widely accepted in a thin film form but if not broken or punctured. Thickness of plastic films ranges from 3-20 mils. Before lying a plastic film pond area should be cleared with gravel greater than 6 inch to protect it against puncture.

Plastic lined farm ponds are particularly suitable for those areas where large quantity of water is lost through seepage, especially where the soil is gravelly and porous. In earthen dams there is also a common problem of seepage through the embankment. Under such circumstances, to check the seepage from all such types of farm ponds

### **Pond Liner Material Comparison**

- HDPE (high density polyethylene)
- LLDPE (low density polyethylene)
- RPE (reinforced polyethylene)

- FPP (flexible polypropylene)
- PVC (polyvinyl chloride)
- EPDM (Ethylene propylene diene monomer)
- Butyl.

### **Conclusion**

Farm ponds have various economical supplementations to small and marginal farmers. Spawning ponds for the production of eggs and small fry, Nursery ponds for production of larger juveniles, Brood ponds for bloodstock rearing, Storage ponds for holding fish temporarily, often before marketing, Fattening ponds, for production of food fish, Integrated ponds which have crops, animals or other fish ponds around them to supply waste materials to the pond as feed or fertilizer, Wintering ponds for holding fish during the cold season. Construction of farm ponds is one of key sources for increasing livelihood of small farmers, various technical aspects discuss above may be considered for its proper outcome.