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Efficiency of Different Lining Materials to Check Seepage Losses

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ABSTRACT

Results of study employing ten different treatments in small ponds indicated that seepage losses were minimum in plastic cover with brick lining pond followed by lime morter with asphalt coating. Lining materials like cement: soil (1: 8), bitumen sheet with asphalt coating and asphalt coating alone ponds were failed to store the water after 48 hours.

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INTRODUCTION

Water conservation under dryland agriculture is possible by adopting water harvesting techniques. Farm pond is one of the way to harvest runoff water. Seepage and evaporation are the major losses from ponds and these ranged from 2.6 to 18.0 mm per day depending upon the nature of the subsoil material (Board on Science and Technology, 1974).

Many methods of seepage control have been suggested and some of them are found promising. These include the use of lining materials such as concrete (Board on Science and Technology, 1974), polymer films, butyl rubber (Meyer, 1963; Cooly and Meyers, 1973 and Dakshinamurty *et al*, 1973) but these are considered to be generally expensive. Some of the local pond sealants as well as chemicals (sodium salts) were used at Anand but did not give the desired effects (Anonymous, 1973). Similar studies using chemicals, local and cementing sealants were conducted at different centres of AICRP for dryland agriculture but the results varied at various locations (Chowdhary, 1974).

The soil at Anand is loamy sand with clay content of 11 per cent. It was therefore, thought to line the small pond with different lining materials for judging their efficiency.

MATERIAL AND METHODS

Ten different lining materials were used in January-February, 1977 (Ist cycle) and March-April, 1977 (IInd cycle). The lining materials (I) brick lining (II) plastic cover with brick lining (III) cement: soil-1 : 6 (IV) cement:soil-1 : 8 (V) cement : sand-1 : 6 (VI) cement : sand-1 : 8 (VII) lime morter-1 : 6 (VIII) lime morter-1 : 6 with asphalt coating (IX) bitumen sheet with asphalt coating and (X) asphalt coating alone were used. On the first day of study, the small ponds having 1 x 1 m with 1 : 1 side slope (total surface area 12.36 sq.m. and capacity 5 cu.m.) were filled up with water upto full capacity at 8.00 a.m. Thereafter at 8.00 a.m. daily readings were recorded to the height of the water column as well as length and width of the pond. The readings

were continued upto two months. After two months, the ponds were again filled to full capacity and readings were recorded daily. The evaporation was recorded separately with the help of pan evaporimeter and losses due to evaporation were considered while calculating the seepage losses. The losses due to seepage were calculated in ℓ/m²/day. The construction cost of each pond and its economic was also worked out.

RESULTS AND DISCUSSION

The seepage losses (ℓ m²/day) as well as percentage seepage loss under different linings indicated that seepage loss (ℓ/m²/day) was minimum (9.0 ℓ/m²/day) in plastic coverwith brick lining followed by 11.5 ℓ/m²/day in lime morter (1:6) with asphalt coating. Irrespective of the date of observation the differences were highly significant. Plastic cover with brick lining and lime morter with asphalt coating were highly superior over other treatments (Table 1). No significant difference in seepage losses was observed among brick lining, plastic cover with brick lining, cement : sand (1:6) and lime morter with asphalt coating. The lining treatments viz., cement: sand (1 : 8), lime morter (1:6), bitumen sheet with asphalt coating and asphalt coating alone failed to store water in ponds after 48 hours.

TABLE 1

Seepage losses under different linings.

Sr. No.	*Treatments*	*Seepage losses ℓ/m²/day*	*Percentage seepage loss of available storage, %/day*
1.	Plastic Cover plus brick lining	9.0	0.18
2.	Lime morter (1: 6) plus asphalt coating	11.5	0.23
3.	Cement : sand (1: 6)	19.0	0.38
4.	Brick lining	51.5	1.03
5.	Cement : soil (1: 6)	88.5	1.76
6.	Cement : sand (1: 8)	340.5	6.81
7.	Cement : soil (1: 8)	2450.0	49.00
8.	Lime morter (1: 6)	2450.0	49.00
9.	Bitumen sheet plus asphalt coating	2450.0	49.00
10.	Asphalt coating	2450.0	49.00
	S. Em. ±	18.86	—
	L.S.D. 5%	60.34	—

The cost of construction per m³ and available storage at different days and other economic considerations are presented in Table 2. The construction cost/m³ was higher in plastic cover with brick lining and minimum in lime-morter lining. Considering the water storage available at 15th, 30th, 45th and 60th day from the day of collection of runoff, the plastic cover with brick lining treatment pond was able to store 2868, 2035, 1393 and 963 litres of water while 2217, 1465, 901 and 536 litres, respectively were stored in lime morter with asphalt coating lining pond. The cement : sand (1 : 6) lining pond stored 761, 327 and 57 litres of water at 15th, 30th and 45th day while no storage was available at 60th day. The brick as well as cement : soil (1 : 6) lining ponds were able to store the water only up to 15th day which corresponds to 34 and 269 litres, respectively. The rest of the other ponds failed to store the water after 48 hours.

Considering the cost of incremental water per litre was the lowest in lime morter with asphalt coating even up to 60th day of storage as compared to other treatments. The above findings showed that the lime morter (1 : 6) with asphalt coating appeared to be economically better lining for controlling seepage losses in farm pond.

TABLE 2

Comparison of different linings for economic consideration.

	Lining type	*Construction cost* Rs.	*Construction cost per* m^3, Rs.	*Incremental construction cost/m^3 over lime morter,* Rs.	*Available storage (lit) at* 15th	30th	45th	60th *day*	*Available storage per m^3 in lit. at* 15th	30th	45th	60th *day*	*Cost of incremental water in litre,* Rs. 30th	60th *day*
1.	Plastic cover plus brick lining	251.00	50.20	43.60	2858	2035	1393	963	571.5	407.0	278.6	192.6	0.17	0.22
2.	Lime morter (1:6) plus asphalt coating	98.00	19.60	13.00	2217	1465	901	536	443.4	293.0	180.2	107.2	0.029	0.072
3.	Cement sand (1:6)	68.50	13.70	7.10	761	327	57	–	152.2	65.4	11.4	–	0.10	–
4.	Brick lining	151.00	30.20	23.60	34	–	–	–	6.8	–	–	–	–	–
5.	Cement: soil (1:6)	55.00	11.00	4.40	269	–	–	–	53.8	–	–	–	–	–
6.	Cement: sand (1:8)	57.00	11.40	4.80	–	–	–	–	–	–	–	–	–	–
7.	Cement: soil (1:8)	45.00	9.00	2.40	–	–	–	–	–	–	–	–	–	–
8.	Lime morter (1:6)	33.00	6.60	–	–	–	–	–	–	–	–	–	–	–
9.	Bitumen sheet plus asphalt coating	138.00	27.60	21.00	–	–	–	–	–	–	–	–	–	–
10.	Asphalt coating alone	51.00	10.20	3.60	–	–	–	–	–	–	–	–	–	–

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