

Rainwater harvesting and storage techniques from Bangladesh

by M.D. Hussain and A.T.M. Ziauddin

It seems a cruel irony that a country with so much rainfall has to resort so often to contaminated surface water for cooking and drinking. There are ways to harvest the clean rain, and to store it for use during the dry season, as many Bangladeshis are already doing. Here they share some ideas and suggestions.

EVEN THOUGH Bangladesh has a very high rainfall from April to October, much of the water harvested and consumed, especially in the rural areas, is contaminated. About 85 per cent of the total population of the country have no access to clean drinking-water and adequate sanitation facilities. The problem is very serious in the southern coastal area (where 18 per cent of the population live), as both surface and groundwater are very saline. The problem intensifies during the dry season and during floods. Although people living in coastal and hilly Bangladesh have been collecting and using rainwater since time immemorial, no specific study on rainwater use in the region was available. An investigation was therefore conducted into the socio-economic aspects of, and the scope for the development of, the rainwater catchment facilities in the country. A case study was conducted in twelve different villages of the Dacope upozilla of Khulna in Bangladesh during the months of October and November.

The objectives of the study were:

- To study the present systems of rainwater use and storage.
- To study the socio-cultural and economic aspects of water use of both rainwater and other locally available sources.
- To perform a comparative cost analysis between rainwater use and the use of water from other available sources.

The study considered the general condition of the water sources, storage practices, water quality control methods, and the organization involved in improving drinking-water supply in the area. In general, the inhabitants of Dacope upozilla use water from ponds, canals or ditches, rivers, tubewells, the DPHE-UNICEF sand-filter facilities, and rainwater. After a series of discussions with a sociologist, an engineer and an economist, an appropriate questionnaire was prepared to collect primary data. The villages in the study area usually consist of two or three *paras*. A *para* is a local name for a distinct cluster of households within a

village. A sampling unit, in this case a single farm household, was selected randomly from each *para* to produce the study sample. Finally, within each selected household, the family leader was chosen to be the interviewee. Key individuals included in the interviews were the village school teacher, members of village committees, common labourers, and different categories of farmers and non-farmers. A total of 36 farm households were interviewed from 12 different selected villages.

Figure 1 shows that during the rainy season 35.5 per cent of households prefer rainwater, while during the dry

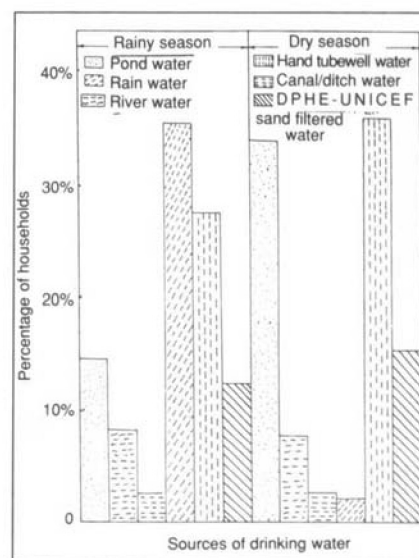


Figure 1. Consumption of drinking-water by households in different seasons.

Table 1: Present situation of drinking-water facilities in the villages of Dacope

Name of village	Condition of hand tubewells					Condition of DPHE-UNICEF sand-filtered facilities			Pond ownership	
	Total no. of tubewells	No. of tube wells out of order	Tubewells in good working condition			Total No.	No. in good working condition	No. unused	No. of public pond	No. of private pond
			No. used	No. unused because of salinity	Total					
Sutarkhuli	8	3	2	3	5	2	2	—	3	3
Anandanagar	4	2	2	—	2	—	—	—	—	—
Satgharia	—	—	—	—	—	—	—	—	—	—
Khatail	4	2	2	—	2	2	1	1	—	1
Khona	3	1	—	2	2	1	—	1	1	1
Baruikhali	4	3	1	—	1	2	1	1	—	2
Chunkuri	18	9	8	1	9	1	—	1	3	3
Batbunia	1	1	—	—	—	—	—	—	—	—
Saheberabad	3	2	—	1	1	—	—	—	—	7
Srinagar	3	2	—	1	1	1	1	—	—	2
Ramnagar	3	1	1	1	2	—	—	—	1	1
Surirdoba	2	—	—	2	2	—	—	—	—	2
Total	53	26	16	11	27	9	5	4	9	23

Source: 1986 office of Sub-Assistant Engineer, Public Health, Government of Bangladesh, Dacope, Khulna and during inspection.

season this dropped to 2.4 per cent, and ponds or tubewells were used.

A joint Department of Public Health (DPHE) and UNICEF programme in the area had been working to provide better quality drinking-water. This programme included the establishment of a sand-filtered tank of 2m × 2m × 2m. A handpump pumped water from a pond (the groundwater was too salty) to the tank, where it was filtered. Even with this filtering, during the dry season the water became salty and people did not want to use it.

Table 1 shows the condition of drinking-water facilities in the twelve villages in Dacope. About 49 per cent of tubewells were found to be out of order, and of those working, 41 per cent were not in use because their water was saline. Of the DPHE-UNICEF sand-filtered facilities, 45 per cent were found to be idle. Only a few of the ponds were government-owned, most being private.

Women played a significant role in the collection of drinking-water. It was assumed that water collection was a woman's job only, and men would do it only under exceptional circumstances. Sometimes the women had to walk very far to collect water in *kalshis*



Rainwater was often harvested using corrugated iron sheets and gutters.

(earthen water containers made by local authorities).

People used rainwater for drinking, cooking, bathing, and washing clothes. It was reported that vegetables, pulses, and rice cooked in rainwater tasted better, and it was very popular when preparing tea. Several users felt that it was not healthy to drink only rainwater, because it did not contain minerals, as groundwater did, but some drank it whenever they could because

they preferred the taste.

During the rainy season the villagers harvested the water and stored it, sometimes enough for the whole year, but more often only for a few months. The roads become very muddy during the rainy season, so rainwater is also harvested to avoid them.

The method of harvesting the rainwater varied, depending on the kind of house the villager lived in (see Table 2). There were three common types of roof in the area: corrugated iron sheets, tiles, and thatch. Roof discharge was a common method of rainwater collection. Gutters made of corrugated iron sheet, bamboo, betel-nut tree and the bark of banana plant had been widely used in the rainwater catchment systems. People with thatched houses usually used other devices to collect rainwater from the open sky, such as an upturned umbrella or a polyethylene sheet, a mosquito net, or a clean sari. The water collected this way was emptied into a *kalshi*, and these in turn were emptied into *motkas*, larger earthen storage vessels. The capacity of storage ranged from 32 to 5376 litres. *Motkas* and *kalshis* were the only popular rainwater storage facilities available in the area.

A *motka* was usually used by rich people for long-term storage. These were semi-permanently placed inside or outside the house. The quality of the stored water varied, depending on the motivation and education of the households. Two households visited in Sutarkhali village were so enthusiastic that they stored rainwater in large *motkas* for year-round consumption. They took water out with a small pre-cleaned pot, and kept the *motka* closed all the time.

An effective technique to maintain the quality of the stored water by treating it, using locally available

Table 2: Rainwater collection and storage scenario in village of Dacope

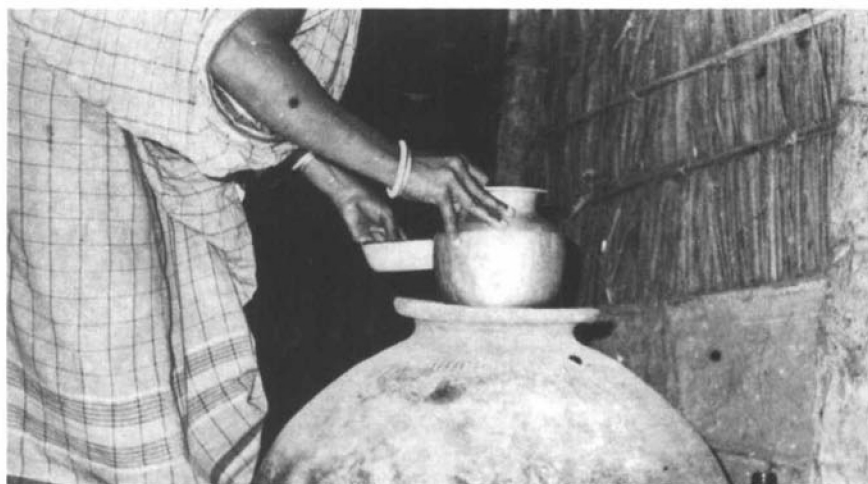
Number of households (persons)	Total rainwater storage capacity for drinking purposes only		Type and number of storage facilities (Type/number)	Method of rainwater collection (type)
	For rainy season use (litres)	Also for off-season use (litres)		
6	90	—	A—5	I
9	—	5376	{ D—4 C—8	I
6	—	4224	D—6	I
5	96	—	A—6	I
8	64	—	A—4	I
22	640	—	C—2	I
6	192	—	{ B—1 A—5	I
5	128	—	{ B—1 A—1	V
12	576	—	{ C—1 B—2	I
5	128	—	{ B—1 A—1	IV
5	32	—	A—2	II
16	960	—	C—3	I
7	288	—	{ B—2 A—3	III
6	724	—	{ C—2 A—4	I
20	384	—	{ B—3 A—2	V
9	—	1280	{ C—4 A—2	I
7	80	—	A—5	11

Storage facilities:

- Type A — a *Kalshi* of 16 litres
- Type B — a *Motka* of 120 litres
- Type C — a *Motka* of 350 litres
- Type D — a *Motka* of 750 litres

Method of rainwater collection:

- Type I — roof discharge through CI sheet
- Type II — roof discharge through tiles
- Type III — roof discharge through straw
- Type IV — polythene paper under open sky
- Type V — bedsheet/sari under open sky



A motka, a large earthen vessel often used to store water.

material, was practised by two households. They stacked snail shells in several layers, and in between the layers, cowdung, straw, or rice husk were placed. Rice husk was spread over the layers and the stack was burned gradually. The burnt shell was collected and added to the stored water at least once a month. It is believed that the calcium (lime) or its compound in the burnt shell is the main element which purifies the water.

Most households with limited storage capacity found it very difficult to maintain quality, as mosquito larvae and other insects developed within two weeks in the stored rainwater. Certain common varieties of fish, known locally as *koi* (*Anabas Testudinews*), *sing* (*Heteropneutes fossils*), or *magur* (*Clarias batrachus*) were introduced into the stored water to eat the larvae of mosquito and other similar insects, but the fish discharge their own excreta in the water, which again reduces the quality of the drinking-water.

Some consumers drink the rainwater after simply filtering it. Few families treated water using known chemicals such as alum, lime, or water-purifying tablets. Sometimes people found frogs,

toads, and the dead bodies of rodents, lizards, cockroaches etc. in the stored rainwater. This was caused by improper storage practices.

Some people did realize the benefits of drinking pure water though, and Table 3 shows the different sources used in the villages.

To improve their supply, about 75 per cent of the villagers wanted to build better and larger rainwater storage units for private use. But only economically solvent households with more than five acres were able to do this. Farmers possessing less than an acre of land preferred the building of a drinking-water storage facility for community use. Most of the users assume that it is the responsibility of the government to provide pure water for them. Only a few households were willing to take out a bank loan at low interest rates to build the storage facility, and then only if the application process was simplified.

Cost comparisons of the different types of water sources were carried out. The cost was calculated on the basis of a consumption rate of three litres per person per day for a family of seven. The collated costs of the

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drinking-water storage facility included the labour cost of collection, and the installation and maintenance costs. The rainwater catchment system was found to be slightly cheaper than the sand-filtered system.

The study concluded that the proper collection and storage of rainwater could solve the drinking-water problem where there is a serious shortage.

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Table 3: Percentage of households using different sources of drinking-water in Dacope, Khulna

Villages	Water source %											
	Pond		River		Canal/ditch		Rainwater		Hand tubewell		DPHE-UNICEF Sand filter	
	Rainy season	Dry season	Rainy season	Dry season	Rainy season	Dry season	Rainy season	Dry season	Rainy season	Dry season	Rainy season	Dry season
Sutarkhall*	—	20	—	—	—	—	40	13.47	—	6.6	6.6	13.33
Anandanagar	25	25	—	—	—	—	—	—	25	25	—	—
Satgoria	—	—	—	—	—	—	—	—	50	50	—	—
Khatall	—	—	—	—	—	—	14	—	—	28	29	29
Khona	10	8	8	—	16	16	26	—	—	16	—	—
Barolkhall*	—	14	—	—	—	—	—	—	14	14	29	29
Chunkuri	14	14	—	—	—	—	14	—	29	29	—	—
Batbunia	25	25	25	25	—	—	—	—	—	—	—	—
Shaheberabad	11	28	17	22	—	—	22	—	—	—	—	—
Srinagar	11	10	—	—	—	—	23	—	11	11	11	23
Ramnagar	—	20	—	—	—	—	40	—	20	20	—	—
Burirdoba	16.5	16.5	—	—	—	—	34	—	16.5	16.5	—	—
Mean	14.75	34.08	8.32	7.80	2.66	2.66	35.50	2.24	27.58	36.00	12.60	15.72

*Note: October to April is considered to be the dry season.