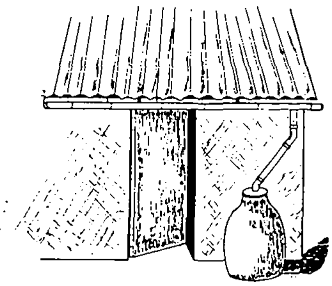
RAINDROP

Rainwater Harvesting Bulletin

July 1992 Volume 7



Focus on Thailand:

Thai Jar Program Reaches Millions of Families

Rainwater harvesting (RWH) is more widespread in Thailand than any other country in the world. The level of effort and results are astounding: more than 10 million 1-2 m3 (1 m3 = 1000 liters) rainwater jars and hundreds of thousands of 6-12 m3 rainwater tanks have been constructed in the last seven years. Most households in northeastern Thailand, where the program has been most successful, have at least one and many have several rainwater jars.

The Thailand RWH program is considered to be one of the most successful examples in the world of how potable water supplies can be increased on a national scale. It is one of the few countries to even approach the International Drinking Water Supply and Sanitation Decade targets for rural water supplies.

Village craftsmen assemble a star fruit mold rainjar.

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The Thai jar program is the most successful example of a country-wide RWH program that significantly increased rural water supplies.

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The successes of the program are largely a product of strong governmental support at all levels, combined with the efforts of nongovernmental organizations (NGOs), the private sector, and grassroots initiatives. It is noteworthy that the government of Thailand, in addition to a variety of standard water supply technology options, chose to wholeheartedly promote rooftop rainwater harvesting as a practical and cost-effective way to increase water availability in under-served rural areas.

Major Lessons Learned

The rapid growth of the Thai program was made possible by a combination of factors that may be relevant to other countries interested in developing broad, as well as limited-scale RWH programs. Governmental commitment and support has been very strong; and national targets and objectives were clearly defined. Rainwater harvesting is a long standing tradition in Thailand, and the annual rainfall is high relative to many other regions of the world. The demand for improved water supplies in rural areas was tremendous, and this demand led to the emergence and growth of many independent jar making micro-enterprises. Thailand also experienced a period of national economic growth and an increase in private affluence during the life of the program which made it easier for families to invest in RWH technologies.

Several jar and tank designs were tested and used on a large scale in the early stages of the program. Problems did occur with some of these designs, particularly the use of bamboo-reinforcement, which had been widely publicized as successful. This experience underlines the need to apply preliminary findings with caution, and when design problems are uncovered, these need to be communicated widely so others do not repeat the same mistakes.

As in many other water and sanitation projects worldwide, health and hygiene considerations were not built into the planning and implementation of the project.

Not surprisingly, the achievement of targeted increases in water supply has not been accompanied by a correspond-

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From the Editor's Desk

This edition features the spectacular growth of rainwater harvesting in Thailand, where over ten million household rainwater harvesting systems have been implemented in the past seven years. The magnitude of the Thai RWH expansion is our strongest proof to date that rainwater can become a significant regional water source. The conditions which supported that unparalleled growth in rainwater harvesting surely include the laudable leadership, commitment, and the willingness to innovate of the Thai government.

For other countries striving to increase potable water supplies for under-served households, important lessons can be learned from the Thailand achievements, as well as from the problems that still confront the Thai rainjar program. The most notable difficulties stem from poor water handling practices which mean that water-borne diseases have not dropped to lower levels in spite of the increased rural water supplies. We are not surprised to learn that, without effective education to promote sanitary water handling and better hygiene practices, many Thai rainjar owners have simply continued their traditional patterns of water handling.

The most common practices are lack of hand washing and use of unsanitary water dippers to draw water from the storage jar. Part of the problem is lack of appropriate technology but a very significant part is the inadequate village-level understanding of hygienic water handling methods. The addition of an effective water tap to the rainjar seems an obvious and simple solution. However, there are problems stemming from the additional cost of the (usually imported) tap, difficulty of repair and repair parts supply, and increased vulnerability to water theft or accidental loss.

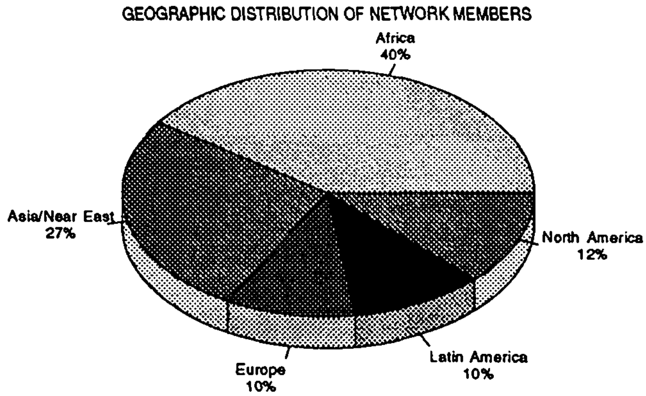
For those households with rainjars not equipped with taps, a water handling improvement may mean using a "dedicated" water dipper which has a handle that is not emersed in the water and which is only used for transferring water from one container to another. However, this would not be practical for removing water from large rainjars.

The effective resolution of these water hygiene issues will not likely be obvious or the same for all locations. It is clear that these are socio-technological issues requiring changes in both technology and behavior. Progress will require the use of significant resources and the collaborative involvement of householders and community leaders.

Carl J. Lindblad serves in a variety of sectors in international development. In addition to rainwater harvesting, his experience includes agricultural extension and training, postharvest technologies, and small business development.

What is the RHIC Network?

The RHIC Network membership currently includes 763 individuals and institutions from more than 101 countries. These members are involved in a range of RWH activities from grass-roots project implementation to university based research. The names and addresses and basic information about each member's rainwater harvesting activities are freely accessible on the RAINCOLL computer data base. RHIC Network membership has increased from 74 in 1986 to the present total. Membership is open to any individual or organization who wishes to join, and has no dues or fees. The chart below shows the geographic distribution of RHIC Network Members.



LETTERS FROM THE NETWORK

Dear RHIC,

Thanks for the very informative RAINDROP. Next year, our graduate students will assist me in preparing a report on rainwater harvesting in Nigeria, and I will send it to you. We have large undergraduate and postgraduate programs in water resources in both teaching and research. Kindly assist our efforts however you can.

Dr. Boniface Egboka
Anambra State University of Technology
PMB 01660 Enugu, Nigeria

Dear RHIC,

Thank you for sending past issues of RAINDROP and information on the RHIC Network which I found very useful. Nepal has huge prospects for RWH to reduce arduous daily treks for water by women in the hills of Nepal. Our Centre For Rural Technology in Kathmandu is also interested in studying and disseminating cost-effective technologies for rainwater harvesting in rural areas, for which your information is heartily acknowledged.

Regards,
Ganesh Ram Shrestha, Executive Director
Centre For Rural Technology
POBox 3628
Tripureswore, Kathmandu, Nepal

Thailand (continued from Page 1)

ing drop in water-borne and sanitation diseases. It is now recognized that social and health considerations are essential in order to achieve the health impacts that can result from improved access to clean water supplies. The government of Thailand is now placing more of its attention on improving hygiene and health education on a national scale.

RWH is Thai Tradition

Villagers in rural Thailand have harvested rainwater for many generations, long before the national-level promotional campaign for rainwater storage in the 1980's, but most families did not collect sufficient quantities of rainwater or enough to last through the dry season. Traditional storage containers have typically been 20-40 liter clay or 100-400 liter ceramic jars.

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Thailand has a high annual rainfall compared with many countries in the world, averaging 1,000-2,000mm per year.

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Thailand enjoys a higher than average annual rainfall compared with countries in other parts of the world, with an average rainfall of 1,000-2,000 mm per year. Eighty-five percent of this annual rainfall occurs during the six months of the rainy season.

The rainfall in the southern region is higher than in the rest of the country, more than 2,000 mm per year. Even during the three month dry season, there is still about 50 mm of rainfall per month.

Thai Government with NGOs Pioneered Massive Initiatives

In early 1985, the Ministry of Interior outlined its ambitious objectives for the nationwide Rainwater Jar Construction Program at a meeting of governors and heads of provincial offices of government agencies. The government, in collaboration with locally-active NGOs, initiated and supported the construction of the first several million rainwater jars and tanks.

Implementation of the program is largely in the hands of the districts, with district officers serving as program managers. The governors, as the program directors for each province, are responsible for fulfilling the objectives of the program.

Each district has its own methods for getting operating funds, but the major source for the program budget has come from the well-established Rural Job Creation Project. Other financial sources have included the Provincial Development Fund from Members of Parliament, the Provincial Administrative Organization, as well as the private sector and non-profit organizations.

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The success of the Thai RWH program results from favorable rainfall patterns as well as strong governmental and popular support at all levels including NGOs, community-based initiatives, and the private enterprise sector.

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A number of multilateral and bilateral agencies also provided funding, including UNICEF and the government of Australia. Research, especially on jar and tank designs and rainwater quality, has been carried out by Khon Kaen University; Mahidol University; and the Asian Institute of Technology.

Rural Areas Targeted

Seventy-two percent of the 57 million people in Thailand live in rural areas. These areas have typically lacked access to clean and adequate drinking water supplies. The overall goal of the national program was to provide the rural population with 5 liters/capita/day (lcpd) of clean drinking water and 45 lcpd for domestic use by 1990.

In order to meet this goal, the government set two major objectives: to provide one 2,000 liter jar (enough for 2 lcpd) to households lacking adequate drinking water storage by the end of 1987, and for each household to acquire two additional jars, enough for 5 lcpd by 1990.

Jars Built by Users and Micro-enterprises

Originally the jar construction program was to be financed by a revolving fund, using start-up money from the government. Villagers were to be involved in the management of these revolving funds. However, the program expanded so rapidly that the administration of the revolving fund could not keep up with the demand, and these funds were generally not used.

Many districts provided construction materials, tools, and training, and people contributed labor to construct their own jars under the supervision of experienced technicians. Khon Kaen University and government agencies provided technical assistance in the preparation and dissemination of construction manuals, and in training technicians. Jar construction centers were established and located either in individual villages or in villages that served whole subdistricts.

It was initially envisioned that villagers would construct their own jars. However, as the program evolved, a number of other options emerged, and the private sector became very much involved in rainjar construction. In some districts, groups of villagers were paid to construct the rainjars and deliver them to households, often with funding from the Rural Job Creation Program.

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Hygiene Techniques for RWH

by J. Hari Krishna

As rainwater harvesting becomes increasingly popular around the world, it is important that adequate attention be given to maintaining and improving the hygiene quality of that water for human consumption. There are a few relatively simple techniques that are generally suggested:

Roof Maintenance

Maintaining smooth roof surfaces can increase the water quantity collected and reduce the possibilities for trash, dust, moss, and other material to accumulate on the roof and contaminate the runoff. The roof or collection surface should not be painted with a product which contains lead or mercury. Tree branches and electric or telephone wires should not be allowed to hang over the roof because these provide a place for birds to perch and their defecation contaminates the roof.

Screen Installation

One or more screens should be installed to prevent trash and other material from washing into the cistern. Any material that accumulates on the screen(s) should be removed regularly to allow free flow of water and to reduce contamination.

First Flush Devices

These are used to divert the first flow of rainwater which flushes off the roof or collection surface. Several types of first flush devices have been developed, ranging from simple overflow type diverters to complex automatic devices. The appropriate choice should be based on local conditions and available resources.

Cistern Cleaning

Cisterns or other rainwater storage containers should be emptied and cleaned at least once yearly, ideally just before the beginning of the heavy rains. Any debris or fine sludge should be scooped and/or flushed out of the cistern. If the remains of any small animals are found in the cistern, repairs should be made to screen off openings to prohibit further entry. Sweep thoroughly to loosen and remove all dirt. The entire interior surface should then be well scrubbed with a 20 percent solution of common laundry bleach in clean water and left for at least 30 minutes before re-filling.

Chlorination

Ordinary household bleach may be used to disinfect cistern water. Up to 4 ml of liquid bleach may be added per 100 liters of water. Chlorination treatment can be done every four to six weeks to maintain disinfection. Caution should be exercised because excessive chlorination not only adversely affects the taste of water but is also dangerous because it may cause cancer. It may be practical to treat only the small quantities of rainwater stored in the home rather than the whole rainwater tank, so that if over treatment occurs the batch can be used for washing without major waste or risk.

Boiling

Where fuel is available, boiling water five minutes will disinfect it for drinking. However, boiling will not rid water of some disease carrying micro-organisms which must be filtered out of the water. Also, boiling with charcoal or wood may be costly both economically and environmentally.

Dr. J. Hari Krishna is the Director of the Water Resources Research Center at the University of the Virgin Islands, St. Thomas, VI 00802, USA.

Cholera Update

What causes cholera?

Cholera is an acute enteric bacterial infection characterized by severe, watery diarrhea, vomiting, and consequent dehydration. Death can occur in a matter of a few hours if no rehydration treatment is provided. Infected persons may show no symptoms, or only mild ones, but they can still spread the disease to others. The route of transmission for cholera is simple: the disease is acquired by the ingestion of an infectious dose of cholera vibrios, usually from water contaminated with the feces of an infected person. Cholera is considered the classic waterborne disease, but transmission through foods prepared with contaminated water or handled in an unsanitary manner is also common. Raw or undercooked seafood from contaminated coastal waters can also transmit the disease. This strain of cholera can flourish in a saline environment.

How to avoid cholera?

The best way to slow the spread of cholera--and other more common diarrheal diseases--is through the use of a combination of standard hygienic behavior and appropriate sanitation and water supply technologies. In practical terms that means disposing of all feces in a sanitary manner--through latrines, waterborne sewage systems, or other appropriate sanitation systems. For this barrier to be effective, 100 percent adherence is required. Even a minor breakdown can have wide ramifications because of the way cholera bacteria multiply and persist in the environment. Latrines must be appropriately designed, well maintained, and used by entire families and communities. If cholera cannot be kept out of the environment, then the bacteria must be avoided or destroyed through water system disinfection. If the municipal water supply becomes contaminated, then people can avoid the bacteria only by drinking safely-bottled or boiled water. Sanitary storage and handling of rainwater also can provide a source of potable water safe from cholera infection. However, sanitary handling of drinking water from whatever source requires effective hand washing using soap. In areas where cholera already exists there is a very high risk of passing cholera pathogens from contaminated hands to communal drinking cups or water dippers. To avoid ingesting cholera contaminated rainwater, boiling or chlorine disinfection is strongly recommended, however extensive boiling of water can be prohibitively expensive and/or environmentally unsound.

Hawaiian RWH Users React to Quality Survey

by Todd Boulanger

There are approximately 25,000 households on the Island of Hawaii (the Big Island) using rainwater collection systems to provide their potable water supply needs. The lack of affordable housing with access to water supply infrastructure makes rainwater catchment systems a frequent topic of discussion. Following the recent periodic volcanic eruptions which have caused an increase in sulfur dioxide in the atmosphere, the Centers for Disease Control (CDC) and the Hawaii State Department of Health cooperatively initiated a survey of rainwater catchment users on the Big Island. The purpose of the survey was to investigate the relationship between acidic rain water, building materials containing lead, and the elevated levels of lead found in catchment water, and to identify households at risk. A follow-up study selected 194 at-risk participants from the 3000 households originally studied, although the results have not yet been made public.

Under a separate research project funded in part by the US Geological Survey, Dr. Yu-Si-Fok and graduate research assistant Todd Boulanger (Department of Urban and Regional Planning, University of Hawaii and Manoa) have surveyed the same 194 at-risk households to gain more information about the age and physical characteristics of the construction materials used for roofing and rainwater catchments on the Big Island. The survey also attempted to identify the adaptive measures being taken by rainwater using householders to reduce water contamination risks identified by the CDC study.

The survey results indicate that rainwater users are generally aware of the CDC warnings about the risks of high lead levels. The most common response to improve water quality has been to bring in drinking water, typically from community standpipe sources, or to purchase commercial water filters. However, a typical problem with water filtration systems is appropriate replacement of the filter following the recommended schedule.

Many filter purchasers have been convinced by opportunistic filter salespersons' claims of complete success in lead removal. Water filter sales promotions offer free tests of water quality to determine if there is water contamination, however there is no similar analysis of water after the filter has been purchased and installed. Regulation of water filter sales has been recommended to prevent fraudulent claims as well as substandard filter quality. In December of 1991 a local law was passed obliging water filter companies to provide accurate information on what the filter will and will not remove from water.

The University of Hawaii survey found that Big Island household rainwater harvesting users often make substandard provisions to safeguard water from contamination by birds, animals and insects. The survey found few RWH users who provided screens over down spouts or adequate cistern covers. The most common cistern cover is woven polyethylene fabric draped over the tank opening. Many householders harvesting rainwater have branches, TV antennas, telephone wires and the like hanging over the roof space providing birds with a place to roost and defecate, contaminating the catchment surface.

Over the next year, the University will provide local rainwater users with information on maintaining rainwater quality, appropriate construction materials, and sizing of catchment area and rainwater tanks. Also, the County of Hawaii Board of Water Supply now provides an educational video comparing various types of water filters on the local market. The EPA has recommended that carbon filters are not effective for removing lead from household drinking water. The Clean Water Board in Hawaii also attempts to inform filter users that if not properly used and maintained, filters may provide an environment highly conducive to the growth of micro-organisms that can cause diarrhea and other water-borne diseases.

Todd Boulanger is a Graduate Research Assistant at the Department of Urban & Regional Planning, University of Hawaii at Manoa.

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As the program evolved, micro-enterprises began to produce good quality rainjars at prices affordable to millions of rural Thai families.

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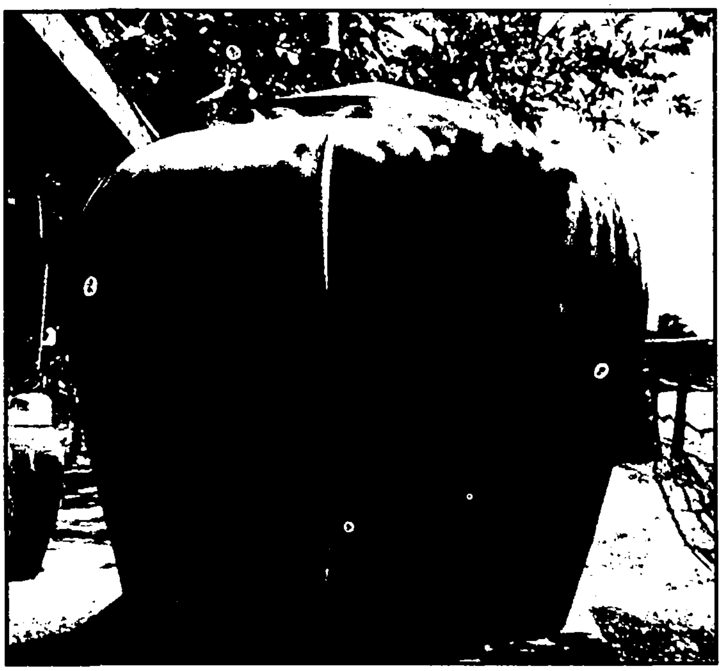
Other districts subcontracted small jar-making factories which sprang up and developed into successful micro-enterprises in many provinces. These village micro-enterprises began producing 2 m3 jars for U.S.$22.00 (1988) including delivery. The current (1992) rainjar price is about US$40, but even at this price, villagers could save very little by constructing the jars themselves.

Estimates vary on the number of jars built by commercial enterprises but these probably amount to over half the total number constructed. Most are built by village-based companies which produce up to 30 jars per day. Completed jars are delivered to customers on small trucks that can carry up to six jars at a time.



Ferrocement rainjar with tap and plastic tube to draw off water.

High Coverage Achieved

Drinking water supply coverage for Thailand based on the intermediate criteria of 2 lcpd was 26 percent in 1981. This increased to 70 percent in 1986, and reached 76 percent by 1988. The rapid coverage increases have been primarily due to the Thai Rainjar Program. Using the 2 lcpd interim criteria, 65 percent of the rural population are provided with drinking through RWH. If the 5 lcpd criteria is used, 36 percent obtain adequate quantities of drinking water through RWH.

Implementation More Rapid Than Planned

In 1985, the program set the ambitious target of constructing 6 million rainjars by June of 1987 as a 60th birthday gift for the venerated King of Thailand. Not only was the goal met, but by 1992, over 10 million rainwater jars were in use. The rapid development of the program is due to a number of factors. There was a large felt need for increased water supplies, and a preference for the taste of rainwater in certain parts of the country, especially in the northeast region.

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In 1985, the national program set the ambitious target of constructing 6 million rainjars in 2 years as a 60th birthday gift for the Thai King. By 1992, there were over 10 million jars in use.

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Adding to the conditions that favored the program's success were Thailand's period of national economic growth and increased private affluence during this time period. Subsidized and affordable cement was readily available, and many skilled artisans already had experience in constructing traditional rainwater jars, who readily learned how to construct the new jar models. There were also many local engineers, technicians, and administrators with a commitment to rural development programs.

While the construction of rainwater jars was much more popular and rapid than originally planned and led to greatly increased access to water supplies, there were also some disadvantages to the rapid growth of the program.

Initially many jars were built without design features to enhance health impacts, such as taps, drainage plugs, and lids. Development of guidelines and dissemination of information on proper operation and maintenance of the systems, and large scale health education did not begin until recently. Rationing of collected rainwater has not always been effectively followed, so many families still rely on contaminated sources during part of the year.

RWH Most Popular in Northeast Thailand

Implementation of the program has been more successful in some parts of the country than others. Forty percent of the jars built are in the northeast region, while only 13 percent are in the southern region. Fewer jars were constructed in the south because alternative sources of water such as shallow wells are more readily available, and the taste of rainwater is less appealing in the south.

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Thailand (continued from Page 6)

A major study found that in northeast and central Thailand, 75 percent rated rainwater as their preferred drinking water source. In the south, where ground water is available, shallow well water is often preferred to rainwater for drinking. Many cite the unpleasant salty taste of rainwater, probably due to the adjacent oceans. Rainwater collection is also common in the south, but smaller jars are more common because rainfall is higher and less erratic in the south. This decreases the storage requirements so that one smaller jar is usually sufficient.

Jar and Tank Designs Refined

In the early 1980s, more than 50,000 bamboo reinforced cement tanks were constructed. Many of these failed due to fungal, termite and bacterial attacks on the bamboo reinforcement. Unfortunately, this design had been widely publicized as successful. In fact many of the bamboo reinforced tanks are still in use, but have been strengthened by wrapping metal reinforcing belts around them.

An interlocking brick design was also developed, but this was later abandoned since the workmanship and skills required were not practical for village conditions. Because the existing Thai rainjar models have proven to be successful on a large scale, major research is no longer being conducted to develop new jar or tank designs.

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Several RWH jar and tank designs were tested and used in the early stages of the program. Major problems occurred with bamboo-reinforced jars, which initially were publicized widely as a successful innovation.

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The jar design which has been promoted by the Ministry of Health has a lid on the top to prevent contamination; a tap for easy access to water; and a drainage plug for easy cleaning. However, jars made commercially usually do not have taps or drainage plugs and are often sold without nets and lids.

This is at least in part because jars with taps and drainage plugs are considerably more difficult to construct and transport. Some villagers also prefer jars without taps because taps may leak and are difficult to repair, and because children play with taps and waste water. If taps are not used, then access to water is usually by bucket or by siphoning off water with a hose. Program authorities have expected the lid and the net to be supplied by jar owners, which often does not occur.

The Thai rainjars are made of sand and cement mortar, and the capacity is typically 1-2 m3. Jars can be constructed using various kinds of molds including home-made jute bag molds filled with rice husks, or standardized Ministry of Health molds including the 54 piece cement mold and star fruit iron or cement mold. After the cement is cured, the jar is slowly filled with water. Sour leaves are recommended to clean the jars before they are used to take away the smell and taste of cement.

Larger rainwater tanks for individual households are typically 3-5 m3 capacity and constructed with iron reinforcement. The Ministry of Health tank design includes a tap, drainage plug, overflow outlet, incoming water tube, bypass tube, and a lid. Construction is typically carried out using a standard mold at the villager's house. Thousands of larger tanks (6-12 m3) have also been constructed at schools, clinics, temples, and private homes.

Rainwater Quality Assessed

A major study, published in 1989, was undertaken by Khon Kaen University[1] in which stored rainwater was analyzed bacteriologically for pathogens. The results from the study of rainwater quality of outside rainwater tanks and jars showed that only 40 percent of samples met WHO standards for total bacterial counts of drinking water; 66 percent met standards for total coliforms; and 57 percent met standards for fecal coliforms.

The route of contamination was investigated by evaluating the quality of rainwater samples collected from the roofs and gutter systems, and outdoor and indoor storage containers. It was found that poor water handling was a major cause of secondary contamination of rainwater. Despite the problems found with water quality, the study concluded that rainwater is still the safest and most economical source of drinking water available in most rural areas.

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Unsanitary water handling was found to be a major cause for secondary contamination of rainwater. Jar designs often did not include a water tap or cover making sanitary water handling nearly impossible.

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Rather than trying to achieve the idealistic goal of meeting WHO safe drinking water guidelines, researchers advocated it would be more beneficial to concentrate resources on improving sanitary water handling practices to reduce secondary contamination of rainwater.

Concerns have been raised that uncovered rainwater jars can lead to increased breeding of mosquitos, which spread dengue fever and malaria. However, research carried

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[1]Khon Kaen University. *Evaluation of Rainwater Quality: Heavy Metals and Pathogens.* Khon Kaen, Thailand. June 1989.

Prevent Cracks in Ferrocement Tanks

by Lloyd Belz

Are you having trouble with leakage from small cracks in your ferrocement rainwater tanks? When the tank is put into service, does it leak, leaving a white stony deposit that forms below the crack? The problem may be very simple to avoid, especially if this problem occurs mostly on the side of the tank that receives most of the afternoon sun.

The sun is the number one enemy of the ferrocement tank builder. Carefully examine the tanks you have built to count the cracks in relation to the position of the afternoon sun, which is the hottest of the day. If the sunny side has more cracks than the shady side, you can improve your next cistern by taking steps to protect the fresh plaster from the heat of the sun.

When a layer of ferrocement plaster dries, the new layer of plaster will not stick to it properly. The two layers will not "heal" together. These "unhealed" layers of plaster are not sealed together and are likely to form a leak. The best way to avoid this problem is to work in the early morning or evening and keep the tank in the shade and moist all of the time while under construction.

There is also the absolutely essential after-construction curing process to be concerned about. This is a completely different matter than the sun drying of fresh plaster. The tank must be kept damp or wet for at least seven days after construction to allow the cement to cure and gain strength. However, if the layers have a dry spot between them where they have not "healed" together, keeping the curing plaster wet will not correct this fault.

Lloyd Belz is a RHIC Network member and the owner of BELZ Engineering and Construction Company, with offices in Hilo, Hawaii; Tonga, South Pacific; and 20706 S.E. Lewis and Clark Highway, Camas, Washington 98607 USA.

New Water Tap Design

For low-income families and communities, water taps may be an expensive addition to the rainwater tank. In rural areas of Nepal, the piped water supply had many standpost taps that were broken by users who were not familiar with the mechanical devices. Poor quality of the water taps and difficult spare parts supply added to the breakage problem, with average tap service life as little as nine months. The new tap design can be locally manufactured in metalworking shops, and consists of a tooled brass plug that is inserted into the end of a standard water outlet pipe that has also been machined with a matching taper. The plug is pulled out when water is needed, and subsequently pushed back into the pipe to stop the flow. A chain attaching the brass plug to the pipe prevents loss or theft. The advantages of the plug tap are that it has no moving parts and does not wear, and is easy to use. It can also be used vertically or horizontally, and can be a direct replacement for an existing broken tap, requiring only a short pipe fitting with tapered end and a corresponding plug. Its use is limited by high water pressure, and if the plug is pushed in too hard it can be difficult to open, but users learn easily.

Although this tap is not yet known to have been used in rainwater jar designs, it may be appropriate for trial implementation. The tap was developed by Jon Lane of WaterAid. For more information, contact Jon Lane, WaterAid, POBox 4231, Kathmandu, Nepal. Fax 977-1-418-479.

Alternative Uses for RWH

by Dan Campbell

Rainwater harvesting systems have traditionally been used as potable water supply sources for drinking, bathing, and cooking. However, in highly urbanized areas of some countries where the piped water supply is being overtaken by demand, rainwater systems are being adapted for alternative uses such as irrigation, and toilet flushing. In association with the National Taiwan Ocean University and Water Resources Research Center, Show-Chyuan Chu and Yu-Si-Fok have conducted research on such alternative rainwater uses in Japan, Singapore, United Kingdom, and the United States, and have found that these can be both economically viable and conserve potable water.

In Japan, piped water supply systems are spread widely over the country serving about 95 percent of the population. But in urban areas such as Tokyo, many office buildings and industries are clustered together, with resulting water shortages in times of draught. During heavy rainfall, flooding can occur due to the high level of runoff. Some modern Japanese buildings are being equipped to harvest rainwater for storage in tanks built in to the ceiling space in their underground structure.

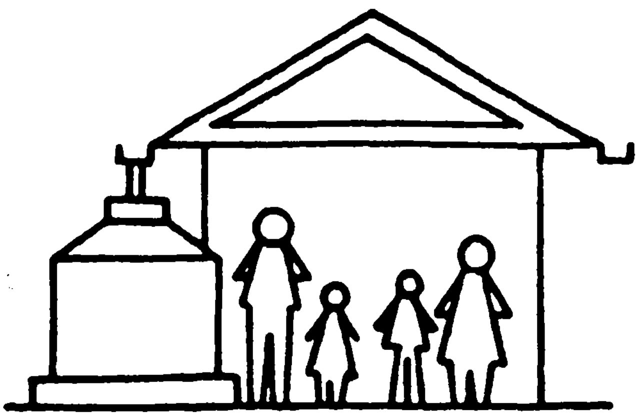
Dan Campbell is the WASH Librarian and Information Officer. He organized and manages the RHIC Network and RAINCOLL database. He has an extensive background in water and sanitation in international development, especially in Latin America.

6th RWH Systems Conference

The next international RWH conference will be held in Kenya, East Africa during August 1-6, 1993. The conference theme will be "Participation in rainwater collection for low-income communities and sustainable development." Conference objectives will be to:

- Identify social, cultural, and economic problems and constraints that influence effective participation in the development, promotion, and use of RWH systems.
- Exchange lessons learned and experience gained in the development and use of various low-cost rainwater catchment technologies.
- Identify factors that affect RWH system sustainability and replicability.
- Explore the potential for expanded rainwater use in rural and peri-urban areas.
- Share experience from research and development of RWH systems design, construction, and water quality.
- Examine factors that influence the effective role of women in development and sustainability of RWH systems.

The conference will bring together researchers, engineers, educators, field workers, administrators, community development officers, project managers, and decision makers. Interested participants are invited to submit, by airmail, abstracts of papers related to the conference objectives, to be submitted not later than December 31, 1992. Full papers must be submitted by March 31, 1993. Send correspondence to: John Mbugua, International Conference on Rainwater Cistern Systems, PO Box 56, Nakuru, Kenya. Fax: 254-2-716-254



Second National Kenyan RWH Workshop

The second national Kenyan workshop on rainwater harvesting systems will take place in Nairobi, Kenya, from August 30 to September 4, 1992. Part of the program is a 2-day excursion to see the many types of RWH projects in the rural Machakos and Kitui districts in Eastern Kenya. Contact Erik Nissen-Petersen, POBox 867, Kitui, Kenya. Fax: 740524.

Regional Asian IRCSA Seminar on RWH Systems

A one week seminar on RWH systems is scheduled for October 4-10, 1992. Professor Isao Minami is organizing the seminar. He can be contacted at: The Department of Agricultural Engineering, Faculty of Agriculture, Kyoto University, Kitashirakawa, Sakyo, Kyoto City, Japan.

News From Africa

UNICEF Kenya and the Kitui Integrated Development Project (KIDP) have now completed more than 500 RWH tanks and 500 VIP-latrines at 300 primary schools serving 150,000 students in eastern Kenya. Each RWH tank has a volume of 46 m3 (46,000 liters), providing up to 115 m3 of water from the two annual rainy seasons. The tanks will supply students with about 2 liters of clean drinking water every school day. The cost is US$1 per 1000 children amortized over 30 years.

In Tanzania, two new RWH projects are underway, one with Swedish financing which is building several types of RWH tanks and the other with UNDP/ILO financing which is building RWH tanks and subsurface dams.

News From The Pacific Islands

A recent USAID-funded study found that almost 90 percent of the larvae of mosquitoes that transmit dengue fever in Fiji are produced in abandoned tires and uncovered RWH storage containers. Recommendations were for community-based control efforts, relying on the strong local tradition of community participation in clean-up efforts, particularly among women.

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out by the Thai-Australia Project found that rainwater jars only rarely contain mosquito larvae, larvae were found in only 0.2 percent of jars. Much more frequently, smaller containers inside the house were found to be the site of mosquito larvae. Covering jars with nylon or wire mesh has been recommended, which would also keep out lizards and rodents.

Widespread Health Impacts Not Yet Achieved With RWH

The achievement of target increases in water supply has not been accompanied by a corresponding drop in water and sanitation related diseases. In fact, little has been achieved in implementing effective hygiene education programs necessary to achieve the health impacts that can result from the provision of clean drinking water.

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In the push to achieve broad dissemination of RWH technology, health and hygiene considerations were not essential parts of the program design or implementation.

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There are a number of reasons for this. Implementing agencies have been directed by technical specialists with little training and background in social processes. Success has been measured by the number of jars built, in part because it is much easier to count jars and tanks than to measure a behavioral change such as improved water handling practices.

Also, not enough is understood about behavioral practices which can have an impact on health (for example, water handling, or hand washing) and there is little understanding of what villagers consider "clean" or "healthy" and how such concepts vary geographically and ethnically throughout the country. It is difficult to handle water in a hygienic way given the design of many existing jars, since many jars were not constructed with a tap, a drainage plug, or provided with a lid or net, as recommended in the Ministry of Health designs.

Water from the collection jar is often transferred to a smaller jar and a communal and multi-purpose dipper is used to get the drinking water from these smaller jars. This added water handling step leads to contamination of the water, especially when hands are not washed before using the dipper. Many villagers do not yet understand that improper water handling can lead to a variety of illnesses.

Health and Education Reach the National Agenda

Social and health considerations are crucial to any water supply program if it is to have lasting health impacts. The government has recently started to move towards developing a re-focused program, shifting from an emphasis on construction to a combination of construction and support programs. A Sanitation Action Plan has been drafted which includes a major health education component, based on social considerations, such as a need to understand the differing attitudes, beliefs, and sanitation behaviors of rural people in all regions of the country.

The focus of national plans is shifting from how to implement and finance the rainjar program on a national scale to improving water quality and health through better use, operation, and maintenance of systems by encouraging the use of health-related design features (such as taps, nets, and lids) and more effective hygiene education. Thai research activities are shifting to measure impacts of the program, and to develop effective hygiene education strategies.

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The focus of national priorities is shifting from jar construction to improving water quality and health, especially through more effective hygiene education.

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It is expected that this new focus will mean fundamental changes from the "top-down" and earlier passive educational approaches which relied heavily on distributing printed materials and using village loudspeakers. The new strategy will be more "bottom-up" with more active person-to-person communication, reinforced by the use of mass media, including television and radio. The plan also calls for greater involvement in active health education by all community groups, including religious leaders, village health volunteers, craftsmen, youths, school teachers--and special input from women in the community.

For schools, a long-term goal of improving sanitation and personal hygiene has been set. Teachers will explain practical hygiene and sanitation practices, and basic water and sanitation facilities will be provided to schools. At the community level, the extension skills of the Ministry of Public Health staff will be targeted so they will be better able to communicate with villagers, understand local practices, and develop programs which are meaningful and necessary for villagers.

As an example of the new emphasis on improving hygiene, the Thai-Australia Project and the Ministry of Health produced materials for primary schools in northeast Thailand based on a rainwater jar cartoon character. This health education program is being extended and hopes to reach 75,000 primary school students. If successful, the program will be expanded to other provinces. Poster competitions are also being held and the best posters on how

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to use rainwater jars are being printed and used as part of the campaign.

Future Directions

Improved relations and communication with neighboring countries should offer opportunities to translate successful aspects of the Thai rainjar program to Laos, Burma and Cambodia. Rural poverty in these countries will however make it difficult to achieve rapid replication of RWH.

Links between Khon Kaen University and Water Resources Institutes in Vientiane, Laos are promising of future opportunities for RWH promotion. Over a quarter of a million Cambodians are living in U.N. camps in eastern Thailand, and more than 80,000 rainwater jars have been built in one camp alone. Many refugees could help disseminate the technology in Cambodia once repatriated. Technical assistance has already been provided by Khon Kaen University to projects which are introducing the technology to parts of Nepal and the Philippines.

Conclusions and Major Findings

The size and scope of the rainjar construction program in Thailand is an unprecedented example of what is possible to achieve in a relatively short time to increase access to water supplies through RWH.

The rapid growth of the program demonstrates that the demand for improved access to water supplies was tremendous. Private businesses were able to produce rainjars at a price affordable to many rural families, and helped the program grow rapidly.

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The major challenge that remains for the Thai Jar Program is to maximize the potential health impacts of this far-reaching program.

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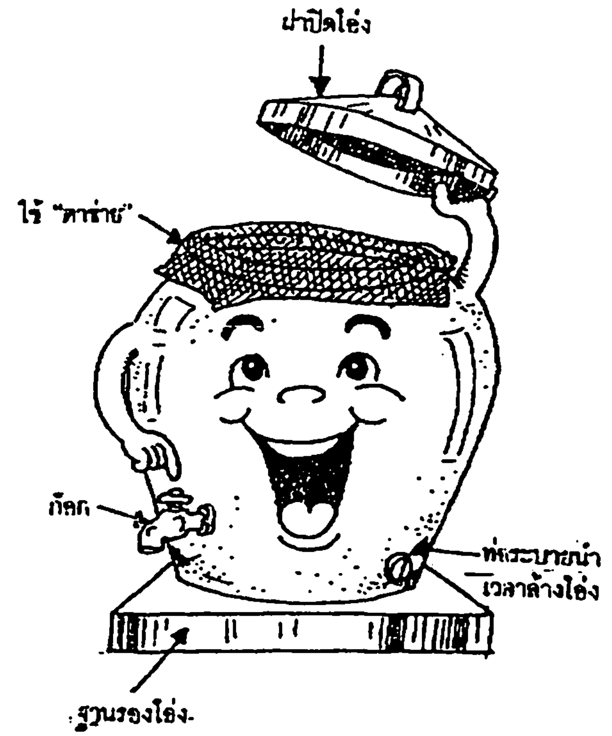
Problems with some of the earlier designs, especially the bamboo-reinforced jars and tanks, highlight the need to communicate research findings, both the positive and the negative, widely and rapidly. This is especially critical when design problems are uncovered in a new technology, so that others using these designs are alerted and faulty designs are not replicated elsewhere.

Recent studies have pointed out problems with rainwater quality, and much of this contamination is due to unsanitary handling of stored rainwater. In the push to achieve high levels of coverage, health and hygiene considerations were not developed as essential parts of the design and implementation of the rainjar construction phase.

Now, families need to learn how to improve the ways they operate and maintain their rainwater systems. Well planned and effective health education and mass media campaigns, especially on hygiene practices and water handling, are essential to improve drinking water quality and health. The major challenge that remains for the Thai Jar Program is to maximize the potential health impacts of this far-reaching program which has been remarkably successful in so many other ways.

This article was prepared by Bonnie Bradford, a public health consultant specializing in water and sanitation, housing, and the environment, in collaboration with Nongluk Tunyavanich, Associate Professor, Mahidol University, Faculty of Social Sciences and Humanities, Salaya, Nakorn Pathom, Thailand; and John E. Gould, University of Botswana, Department of Environmental Science, Gaborone, Botswana. The article also draws upon a number of published documents about the Thailand program.

Thai rainjar cartoon character is happy to have a cover and screen, tap, outlet drain, and solid foundation.



Information Resources

Concrete Roof Tile

The Swiss Center for Appropriate Technology (SKAT) is an information center on small-scale clay and cement roofing tile manufacture. Low cost, durable roofing materials that can be locally manufactured may be a key component of a successful RWH program, especially where the only option is imported metal sheet roofing. SKAT now distributes free copies of two four-page leaflets about small-scale manufacturing of concrete roof tile in India and in the Republic of Kiribati in the Central Pacific. The Indian document includes information on cost, maintenance, and marketing issues, and gives useful information about the regional center in New Delhi. The Kiribati document discusses a flat roof tile design made with a low water content cement sand mix that was developed to cope with poor quality coral sand causing major problems in tile strength and high porosity. For free copies of the leaflets and a free publications catalog covering 350 titles on Building Materials, Energy and Rural Water Supply, contact: SKAT Bookshop, Tigerbergstrasse 2, CH-9000 St. Gallen, Switzerland

Rainwater Catchment Systems for Household Water Supply, by John Gould, 57p., 1991.

This new publication reviews state of the art RWH systems technologies. Using case studies from Asia, Africa, and Australia, major technology and program issues are reviewed. Successful strategies and approaches to project planning, implementation and evaluation are examined, with information regarding costs, financing mechanisms, and water quality. The report is available from: ENSIC, Asian Institute of Technology, POBox 2754, Bangkok 10501, Thailand. US$20 air-mailing included. US$12 for requests from developing countries.

RAINDROP is available in FRENCH!

Expand the RHIC Network

Membership in the RHIC Network is free of charge and open to any individual or organization interested in rainwater harvesting. Membership includes access to the RAINCOLL database and being added to the mailing list for RAINDROP.

The RAINCOLL database is intended to serve all RHIC Network members, and access to its extensive collection of publications and data is available to any member. RHIC currently receives 20-30 requests per month for technical information. If you request information, please be as specific as possible concerning the information you are want, and address your request to Dan Campbell at RHIC, WASH Operations Center, 1611 North Kent Street, Room 1001, Arlington, VA 22209, USA.

The wider the RHIC network is, the more information and experience there will be to offer Network members. You can help expand the Network by passing on to RHIC the names and addresses of other individuals or organizations who may wish to be nominated as Network members. Thank you for taking the time!

WASH

WATER AND SANITATION FOR HEALTH PROJECT

For additional information about activities and reports highlighted in this issue, contact:

WASH Operations Center
1611 North Kent Street, Room 1001
Arlington, Virginia 22209 USA

Water and Sanitation for Health Project, Contract No. DPE 5973-Z-00-8081-00, Project No. 836-1249. Sponsored by the Office of Health, Bureau for Research and Development, U.S. Agency for International Development, Washington, DC 20523.