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**WATER, SANITATION AND HYGIENE:
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**Innovative rainwater harvesting techniques
for emergencies: Lessons from the field**

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In the context of global climate change, a growing concern over lowering ground water tables and increased flooding, rain water harvesting (RWH) presents itself as a water source with significant environmental, social and economic benefits worth serious consideration. This paper presents a practical case study of new innovative ideas for simple household level RWH techniques appropriate for transient populations in emergency and post emergency situations, together with analysis of performance, based on a practical field test in Southern Sudan. RWH in its many forms should always be considered as a potential water source to supplement other supplies. This is especially true in emergency and post emergency situations, where RWH in its simplest form, can become a self-help water source available to all, while in more complex forms, it can contribute as a significant water source to large communities and camps.

Introduction

Tearfund is actively seeking to address the global issue of climate change through local action. In light of recent research into the issue of climate change and lowering groundwater tables in Darfur (Bromwich 2007), Tearfund has piloted an innovative Rain Water Harvesting (RWH) programme to develop new simple household level rainwater harvesting techniques that can be applied in emergency and post emergency situations, in order to minimise reliance on groundwater resources and contaminated surface water sources, which require expensive treatment measures. The 'RWH in emergencies' pilot programme focuses on simple 'ultra-low cost' household level RWH innovations to support water self-supply, especially applicable for transient populations in emergency and post emergency situations. This paper presents a practical case study of the RWH in emergencies pilot programme, with an analysis of performance based on practical field test results.

The context

The pilot project was carried out in the post emergency humanitarian context, in a village in Southern Sudan facing an influx of returnee refugees. However, it could just as readily apply to emergency and post emergency situations in many countries around the world.

The location chosen for the pilot programme was a village known as Omdurman in an area known as 'the Highlands' of Aweil East, Northern Bahr el Ghazal, which is one of the most underserved areas of Southern Sudan. The area is inhabited by approximately 124,000 people of mostly Dinka Malual ethnicity. During the 22 year civil war a large proportion of the population was displaced and since the signing of the Comprehensive Peace Agreement in January 2005, the area has received a high number of returnees.

The problem

As in many locations around the world, population movement, in this case returning refugees, caused by complex humanitarian emergencies, has placed incredible strain on the existing meagre 'improved' safe water sources. Women and girls who bear the burden of water collection have to contend with long queues

at water points. This forces many women and girls to fetch water at night, when the queues are shorter, but also increases the risk of gender based violence or attacks from wild animals. In addition dramatic climatic seasonal changes pose a considerable challenge to the community. The Highlands receive heavy rains from May until September / October, during which access is severely disrupted due to the poor roads and many swamps. Clean drinking water wells are very few and widely spaced, so that during the wet season, disease and sickness increases as communities resort to unsafe surface water sources (ponds or puddles) near their homes. Health statistics collected from Tearfund and Government Primary Health Care Units (PHCU) clearly demonstrate a marked increase in the incidence of diarrhoea, other water related diseases and resultant morbidity and mortality during the wet season.

In Southern Sudan, as in many other fragile states, the situation is one of reduced capacity, weak civil society structures and weak government institutions that lack adequate resources to provide sustainable, secure access to safe drinking water and sanitation for the population. In such contexts self-help water supply often becomes a primary water source.

Simple and innovative ‘ultra low cost’ RWH techniques for emergencies

The provision of adequate water is a complex issue and one that often needs multiple approaches to ensure security of supply. In Northern Bahr el Ghazal, the primary water sources are deep borewells and, in some areas, rivers. However, an often overlooked, easily accessible and sustainable source of safe drinking water during the wet season is rain, which falls in abundance in most tropical and sub-tropical climates. Self-help RWH water supply has distinct advantages for the users, namely easy access, low-cost, and ease of management (Carter, 2008).

For this pilot project a number of innovative low cost RWH techniques were adapted for the Southern Sudan context. Firstly, very low cost domestic roofwater harvesting methods were successfully piloted using corrugated iron rooftops, various forms of guttering, first flush diverters, with collection and storage in plastic or ferro-cement tanks. Much of the technology introduced was based on research and testing into new technology for very-low cost domestic roofwater harvesting carried out by the University of Warwick (DTU 2002). Local tradesmen were coached in techniques for fabrication and installation of the systems. However, as in many emergency and post emergency situations, there are very few permanent structures in Omdurman. The structures with corrugated iron rooftops suitable for RWH were limited to one health clinic and a few shops. Most of the population live in simple thatched roof structures, known as Tukuls, which do not lend themselves towards traditional roof rainwater harvesting techniques (DTU 2002:14).

Therefore in order to make self-help RWH accessible to the majority of the population living in simple thatched roof structures. A second innovative simple ‘ultra low cost’ approach to RWH without rooftops was therefore researched and adapted as part of the pilot project.

As with many transient populations, especially in emergency and post emergency situations, plastic sheeting is a basic commodity that many households obtain from distributions at IDP and refugee camps, or purchase on the local market. These plastic sheets are used for multiple purposes including shelter for homes or shops, and at the same time can be used for RWH.

The innovative ‘ultra-low cost’ idea is to use plastic sheeting together with other locally available materials to intercept rainwater and channel it into suitable collection containers. Several designs have been successfully piloted to collect rainwater and channel it into jerry cans and drums. All the materials used were locally available, including storage containers which in many cases were locally made clay pots. The most successful design piloted was to simply tie the plastic sheet at its corners to four poles buried in the ground. Water was then channelled into collection containers, positioned at the edge of the sheet, or through a hole at the centre of the sheet.

During the pilot study, the whole community (men, women and children) participated in various exercises to design innovative methods to use plastic sheeting, to capture rain water in a common household container. Children, who often bear the burden of water collection, came up with some of the most innovative methods, which were then tested.

An illustration on the success of such a method of water collection was, during a market demonstration, where a 6m² plastic sheet was used to fill a 100 litre tank in approximately 30 minutes of rainfall. After the pilot programme demonstrations most community members were convinced of the benefits of rainwater harvesting and many constructed similar rainwater collection systems at their homes. Initial follow-up monitoring indicated that a high proportion of the community, are collecting rainwater as a primary water source during the wet season. Some members of the Omdurman community also volunteered to spread



Photograph 1. Example of Plastic Sheet Rainwater Harvesting Systems



Photograph 2. 100L Rainwater Collected in 30 minutes from a 6m² Plastic Sheet

knowledge about self-help RWH techniques to neighbouring communities. Further follow-up monitoring and evaluation will be carried out over the next three years to conclusively verify the level of technology uptake within the wider community.

Self help ‘ultra low cost’ rainwater harvesting does not need to be limited to the use of plastic sheeting for harvesting, other locally available materials can also be successfully used, such as single corrugated iron sheets and cloth. Self-help traditional methods of rainwater harvesting used in Uganda and Sri Lanka also include rainwater collection from trees, using banana leaves or stems as temporary gutters; up to 200 litres may be collected from a large tree in a single storm (Practical Action, 2005).

All methods of ‘ultra low cost’ RWH are especially applicable for transient populations in emergency and post emergency situations, and can become a sustainable supplementary water supply option for many vulnerable populations. This opinion is supported by Thomas and Martinson, who state “there is certainly opportunity in refugee camps for RWH to supplement bowsered supplies and there is scope for modifying the design of emergency tents to facilitate the collection of run-off from their roofs. Such modifications include hemming up the edges of tarpaulin roofs to form pseudo-guttering and issuing funnels to assist the direction of run-off into containers” (Thomas and Martinson 2007:124).

Analysis of the ‘ultra low cost’ RWH techniques for emergencies field trial

Environmental benefits and challenges

Key environmental benefits of RWH include flood attenuation and reduced demand on groundwater reserves. In addition where care is taken to ensure a clean harvesting surface and collection container, the quality of water is good and can be safely consumed without further treatment; and in tropical and sub-tropical climates the quantity of water collected from a rainfall event is excellent.

One environmental challenge encountered was strong winds which often occur before rainfall, and have a tendency to destabilise lightweight plastic sheet RWH structures. This led to various modifications to enhance stability, such as attaching each edge of the plastic sheet to longitudinal timber poles.

Social benefits and challenges

Key social benefits of RWH include ease of access, good taste, and ease of management. In addition point-of-use water collection results in reduced risk and burden to women and children during water collection; and due to its self-help nature, plastic sheet RWH can be an interim measure used by communities following a disaster and before aid arrives. These social benefits are clearly reflected in comments from the community in Omdurman; “Rain water tastes good, it is better than borehole water”; “The community is happy about rainwater harvesting, they now have more water to use” (Daniel Aleu).

One significant social challenge is that it often takes some effort to convince people that rainwater is a good drinking water source, and in fact many water sector professionals still tend to focus on perceived disadvantages, rather than advantages of self-help water supply (Carter, 2008).

Economic benefits and challenges

Key economic benefits of RWH include the low cost – especially the ‘ultra-low cost’ self-help water collection methods, which can be accessible to the majority of the poor and most vulnerable; and the potential for livelihoods development. For example some women stated that their 20 litre water collection containers were too small and they would require a bigger storage container, this was viewed by some to be an economic opportunity; “Our women are able to make a small pot out of clay...now at least we can make a bigger one from ferro-cement...one that can fit more rain water” (Jacob Achuil, village leader); “Some people who have a little bit more money in the community have already begun asking us if we can be able to build them their own individual tanks” (Jackson Achuil, ferro-cement builder).

Potential for scaling-up

Plastic sheet rainwater harvesting is a simple self-help water supply method that rates highly in terms of both cost-effectiveness and independence of management. The potential for scaling up and innovation of plastic sheeting RWH is high due to the lack of technical skill required to use this technique. However, one area that always needs to be addressed, as this form of RWH is scaled-up, is hygiene promotion in relation to cleaning the rainwater harvesting surface, first flush diversion, clean collection containers and appropriate storage of harvested rainwater. This is important especially in areas where stored rainwater will not be chlorinated or otherwise treated.

Tearfund is encouraging the community to sensitise their neighbours on the technique and spread the concept of RWH. The mentoring of the community on skills as well as Trainer of Trainer sessions for RWH through identified members of the community has been core in Tearfund’s approach to enable replication of the concept and empowerment of the community.

Conclusion

A holistic approach is always needed to address the problem of sustainable access to adequate safe water supply and sanitation. However due to its significant environmental, social and economic benefits, RWH in its many forms should always be considered as a potential water source to supplement other supplies. This is especially true in emergency and post emergency situations, where RWH in its simplest forms, can become a self-help water source available to all, while in more complex forms, it can contribute as a significant water source to large communities and camps.

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