

An integrated drinking water quality assessment of rainwater harvesting jars and the related Socio-economic conditions and gender issues of Chappani VDC-1, Palpa District

Pradita Shakya and Subodh Sharma

*Department of Biological Sciences and Environmental Science, Kathmandu University, Dhulikhel, Nepal
praditashakya@hotmail.com, P. O. Box: 9252, Kathmandu*

Abstract

Rainwater is the most viable option for storing water in Chappani village development committee ward no.1 of Palpa district in Nepal. In addition to drinking, rainwater is used for several other multiple purposes. During the present study physical, chemical and microbiological parameters of rainwater stored in Ferro cement made jars was carried out during the month of March (Pre-monsoon) in the year 2003. Related socio-economic conditions and gender issues due to the implementation of the jars were also studied. The quality of water was found suitable for drinking purpose in terms of physical and chemical parameters but microbiologically it was unsafe. However, the water availability due to this alternative and simple technology has supported the community in saving time in fetching of water and has improved the socio-economic status by contributing the excess time in social activities or promoting small income generating activities.

Introduction

Nepal, situated in the Hindu Kush-Himalayan region is the largest storehouse of fresh water at lower altitudes is surprisingly suffering from water scarcity problems due to lack of advanced technologies and proper management. The country gets excessive rain (80%) in monsoon period (Jun-Sep) causing floods and landslides while leaving the rest of the year dry. So, users must capture rainwater when it is abundant in order to use it later when it is in scarce. In Nepal, some organizations like ICIMOD, FINNIDA, etc. are effectively installing Ferro-cement rainwater harvesting technology for the affected rural areas in the mid-hills of Central Himalayan Zone such as Gulmi, Palpa, etc. The system includes five basic components such as catchment area, conveyance system, filtration technique, storage tank and distribution system.

Description of Study Area

Chappani VDC (27° 34'– 27° 54' latitude and 83° 15'– 84° 22' longitude) lies in the western development region of Nepal. The geological setting of Palpa district consists of Middle mountains, Siwaliks and the Terai. The climate type of Palpa district is tropical, sub-tropical and temperate. It has an average temperature of Max - 25.19 °C and Min - 15.92 °C, average rainfall of 141.96 mm and average relative humidity at 8:45 - 80.33% and at 17:45 - 76.75%.

Materials and Methods

Thirty six jars are examined. The equipment used in experimental investigation is ISO-9000 Certified Hach equipment Model DREL / 2010, 2600-05 and chemicals from Hach, USA accepted by USEPA (United States Environmental Protection Agency), Titration and Pour plate Method. The basis for socio-economic assessment and gender analysis is questionnaire survey, group discussion and personal interaction with key respondents of the village. The data obtained from the questionnaire was edited, coded and classified. The important data were tabulated and further analyzed by using simple statistical tools.

Results and Discussions

Water Quality:

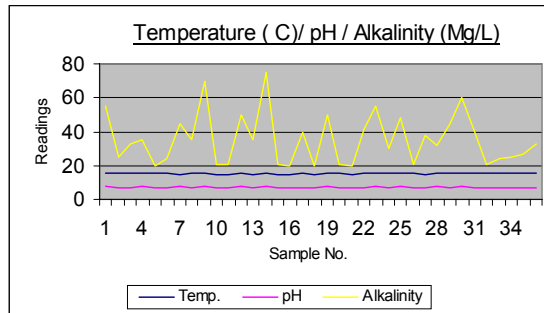


Figure 1. Temperature, pH and alkalinity range in water samples

The colour, taste and odour of the rainwater are acceptable. The range of temperature variation is 15⁰C-15.8⁰C. pH of the water of 36 jars is in the range of 7-8.1 i.e. within WHO guideline value. The samples of the site show total alkalinity of 20-75mg/L. Alkalinity, like acidity is governed in water by microbial decomposition.

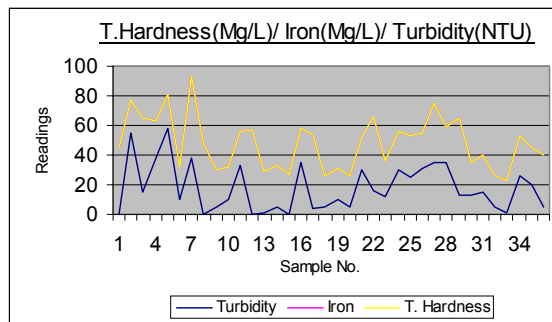


Figure 2. Total hardness, iron and turbidity range in water samples

The hardness measured is in the range of 21-57mg/L (slightly hard). The iron content in all the samples is very low (0-0.21mg/L). The results are due to the exercise of adding water from other water sources. Seven (sample.no.2,4,5,7,16,27&28) of the 36 jars investigated have turbidity in the range 35-58 NTU which is much higher than the WHO guidelines value. The high turbidity is the result of various dust particles or materials suspended in the atmosphere and on the roof.

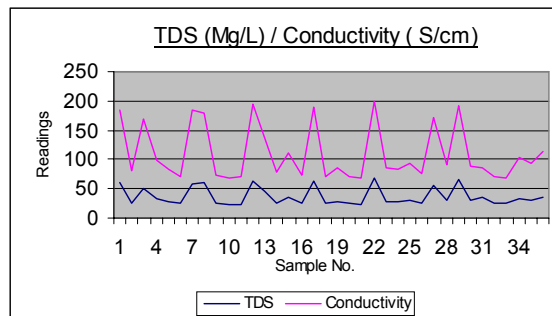


Figure 3. TDS and conductivity range in water samples

All the samples have permissible Total Dissolved Solids in the range of 22.5-68.2mg/L. Sample no. 9, 15, 22 shows conductivity of around 193.1-199.5 μ S/cm whereas sample no.13, 21, 33 shows 68.2-69.2 μ S/cm of conductivity. High conductivity (>750 μ S) of water is unsuitable for irrigation.

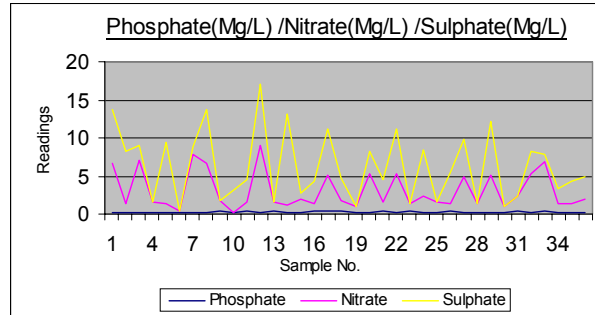


Figure 4. Phosphate, nitrate and sulfate range in water samples

The amount of sulphate present in the analyzed rainwater of the site is just about 0-12mg/L. The samples contain low amounts of phosphate in the range of 0.10-0.42mg/L. The activity of storing water in the jar fetched from far away sources have led to the attained results. None of the samples of the site exceeds the WHO guideline value of nitrate and is in the range of 0.1-8.9mg/L. Its origin in water can be both from natural and artificial sources such as fixation of atmospheric nitrogen by micro-organisms, plant debris, bird excrement, cross contamination by humans, etc.

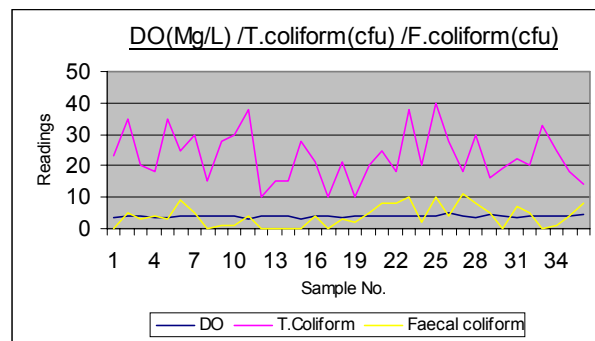


Figure 5. DO, total coliform and faecal coliform range in water samples

DO is in the range of 3.1-4.9mg/L at 15⁰C-15.8⁰C that is optimum for drinking water though low DO level is not considered unsafe for health. Ten RWH jars are all free from faecal coliform but the rest of the samples (26 jars) show 1-11cfu/100ml contamination. This is probably due to cross contamination when water is added to the jar from other water sources or the bird droppings, decayed materials on the roofs from where the water is harvested and improper maintenance of the jars. The samples of the site contain high TPC. They are in the range of 10-40cfu/100ml.

Socio-economic Condition:

People of the water scarce zones often have to restrict various social activities, personal development, entertainment, etc. due to pre-occupation of fetching daily quota of water needed for household activities. With water availability it has eased the tasks for living especially for women. The facility reduced the conflicts over fetching water. Now that jar water is provided children can devote full time to studies rather than worrying about water requirements. The jars have eased the tasks for small scale income generating activities like small shops, restaurants, vegetable farming, etc. This enhances the economic status of the village people.

Water Use Pattern:

Drinking, cooking, washing clothes, washing utensils, bathing, cattle feeding, kitchen gardening are the seven major sectors where water is being used. The priority is using water for washing utensils and cattle feeding.

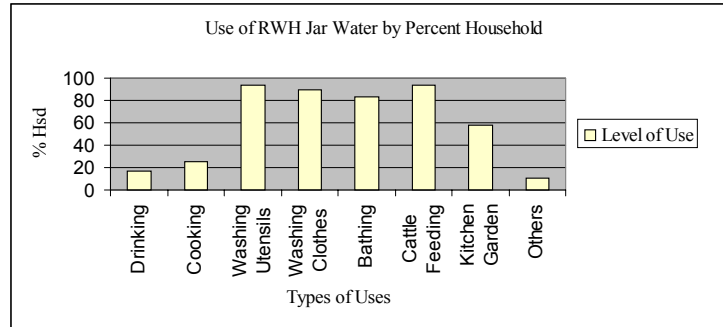


Figure 6. Use of jar water by percent household

Operation & Maintenance of Jars:

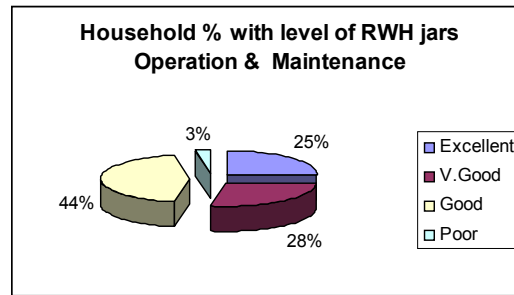


Figure 7. Level of operation and maintenance of RWH jars by percent household

The result obtained shows that only 25% of the houses maintain the jars in excellent condition whereas 3% are in the worst state in terms of regular flushing, closing of lid & PVC net, cleaning and adding water from other sources. It is extracted that the level of maintenance in the *Newar* community is good compared to other ethnic and disadvantaged groups of the community as the *Newar* community seems to be aware of good health and hygiene.

Conclusion

The RWH scheme in the study area has contributed to clean environment, good health and hygiene. The socio-economic status of the people has been uplifted to some degree and women have benefited the most with less physical stress of fetching water from distance sources day and night. The programme under FINNIDA and HMG/N has been successful in implementing the jars in Palpa District with personal interests and the enthusiasm of the people to eliminate water problem of the community.

Recommendations

The activity of adding water into the jar from other water sources should be discouraged. The turbidity of the rainwater can be reduced by adopting proper filtration techniques. The gutters should be made in such a way that it can be easily removed and cleaned. The RWH technology should be adopted in urban areas too.

Acknowledgements

We would like to express our sincere thanks to ICIMOD, Lalitpur for providing financial support.

References

Banskota, M. & Chalise, S., 2000. Waters of Life – Perspectives of Water Harvesting in the HKH. ICIMOD, Kathmandu

Roark, P.D., 1984. Women and Water. In *Water and Sanitation: Economic and Sociological Perspectives*. New York. Academic Press, pp 49-68

United Nations Environment Programme (UNEP), 1983. Rain and Stormwater Harvesting in Rural Areas. Tycooly International Publishing Limited.

WHO, 1993. Guidelines for Drinking Water Quality. 2nd ed., Geneva.