The Study of Water Supply and Traditional Water Purification Knowledge in Selected Rural Villages in Tanzania

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INTRODUCTION

Water supply is one of the key natural resource bases that are inevitable for sustainability of human and environmental health. There is a strong and direct link between people's health and the development of communities. Gleick (2002) and the World Health Organisation (WHO) (2003) summarised these links as: poor health reduces life expectancy and educational achievement; it reduces investment and returns from investment (as production, productivity and employment decrease); it reduces parental investment in children (and increases the fertility rate); it increases health inequity and poverty; and it reduces social and political stability.

Inadequate water services together with sanitation to the rural poor are among the most serious challenges facing the developing world. Every year, approximately 3.4 million people die due to water-borne diseases, with the greatest health burden falling on children (UN-Habitat, 2003). Rural water supply and sanitation projects that are now implemented in several rural districts in Tanzania with credit financing from the World Bank are facing common types of drawbacks of which poor governance and financial constraints are prominent. The outcome of this is that the few installed water facilities apart from being unable to suffice the needs of the populations, are also partially functioning, frequently impaired or completely broken down due to poor operation and maintenance.

Singida rural district is one of semi arid areas in central parts of Tanzania where people suffer serious shortage of water supply. The installed water supply schemes are unequally distributed among villages in such a way that some villages lack any potable water source. Even in those villages where a few water schemes exist, they suffer the same level of water shortage because more than 70% of the schemes are malfunctioning. Small rainwater reservoirs (charco dams) which are constructed through the Participatory Agricultural Development Programme (PADEP) under the World Bank are alternative sources of domestic water supply for most villagers in Singida rural district. The water from charco dams is however very turbid and heavily polluted by human and animal excretion and this makes purification of the water using local knowledge necessary before it is used for domestic purposes. The use of traditional knowledge in treating water in rural communities that lack potable water in the developing world has been reported by many authors (Tripathi et al., 1976; Jahn and Dirar, 1979; Jahn, 1984; Sutherland et al., 1989).

The purpose of this study was to investigate the water supply problems in four villages located in Singida rural district in Tanzania and the use of local coagulants for purification of polluted domestic water supply.

METHODOLOGY

This is a follow up study on a preliminary survey conducted by the author in Singida rural district to investigate the general water supply situation in the district. In this study, data came from primary sources in which questionnaire and focus group discussion were used to gather data on the magnitude of water supply problems and the existence and practicability of traditional water treatment knowledge employed by women in the study area. Participatory techniques were used to learn through observation and hand-on experience of the practices and procedures involved in traditional purification of turbid waters. The aim here is to provide a practical dimension and also to make findings context-specific and reflective of reality.

The four villages that were selected for this study include Msange, Mipilo, Mangida and Sifunga villages. The villages are located in Maghojoa ward in the division of Ilongero in Singida rural district. These villages were selected for the study because they are among several villages in the division that face severe water supply problems and where the purification of polluted water using locally available materials is very common. Also, for logistic reasons they were the most convenient areas to conduct the survey.

Table 1: Population of study villages

Name of village	*Male*	*Female*	*Total population*	*No. of HH*	*No. of HH interviewed*
1. Msange	2535	2192	4728	900	85
2. Mipilo	2259	2193	4442	886	73
3. Mangida	408	520	928	540	49
4. Sifunga	1620	1694	3314	630	59
Total	6922	6599	13412	2956	266

Focus group discussions were done with 35 people that included the ward executive officer (WEO), village executive officers (VEOs), village water committees, 3 elders from each village (both male and females), a nurse from the dispensary and an official from the district water department who was the facilitator of the discussion. Interviews based on a questionnaire were conducted between 49 and 85 households in each village using systematic random sampling (Nachmias and Nachmias, 1996). In the case of households that consisted of 1 to 2 families, each family was interviewed as separate respondents. The respondents in households included men and women depending on their availability at home at the time of conducting interviews. Nevertheless, women were the main respondents on issues pertaining to traditional water treatment. Table 1 shows the breakdown of the study population and the number of respondents of the survey.

The quality of raw and treated water from charco dams were measured at the site using pH meter (HACH model-sension 156), potable microprocessor turbidity meter model HI 93703 (Wagtech) and field membrane filter and incubator (the delagua-water testing kit).

RESULTS AND DISCUSSION

The Study Area

The studied villages namely, Msange, Mipilo, Mangida and Sifunga are located in the Singida rural district in central semi arid zone of Tanzania. The population of the villages are 4728, 4442, 928 and 3314, comprising of 900, 886, 540 and 630 households respectively. 51% of inhabitants are male and 49% are female. The average number of people per household is 5.

The areas, rainfall pattern is typical of the central semi arid zone that is characterised by unimodal rainfall from December to March with a total annual precipitation between 500-800 mm. The rainfall is frequently erratic and much of the area is prone to drought and degraded by anthropogenic activities (Kiunsi, 1994; Kilewo *et al.,* 1995).

Occupational Activities

Subsistance farming, which is entirely dependent on rain fed, is the most important occupation of the inhabitants in the study area (Table 2). The main products of their labour are food and cash crops as well as livestock. The main crops that are grown in the study area are mostly drought resistant. Cash and food crops are sold to earn the people some money for other family needs. The results show that an average of 99% of the inhabitants (both males and females) in the four villages are occupied in farming activities. Also, livestock keeping which is a male dominated task is practised by 22.5 % of households, while 3.5% of households in addition to farming have formal employment in primary schools, dispensary, etc. Other households have multiple occupation such as owning retail shops, local ginnery for women, transport business and so on.

Table 2: Occupational activities of inhabitants in the study area

Villages	*Occupational Groupings (% of households)*			
	Farming	*Livestock*	*Formal employment*	*Others*
Msange	99	30	8	3
Mipilo	99	20	4	2
Mangida	99	15	2	2
Sifunga	99	25	1	1
Average	99	22.5	3.5	2

The General Water Supply Situation: A Drive for Using Local knowledge for Water Purification

The main sources of potable water supply in the study area are windmill (s) and borehole (s); the non-portable sources are dam(s), charco dams and traditional wells. In addition, seasonal streams and ponds are used to supplement the existing sources during the rainy seasons. The water supply situation in the surveyed villages is very unsatisfactory. Despite the joint efforts of the government, donor agencies, and local communities in installing a few water schemes, most of them are malfunctioning (Table 3). It is evident from the result of this survey that a large proportion of the villages in Ilongero division do not have access to sustainable water supply sources. It was noted during the discussions that less than 20% of the inhabitants in the study area do have access to reliable water supply. Moreover, Sifunga village does not have any kind of water supply source despite its high population. The consequence is that the majority of inhabitants have to travel long distances in search of water. In most cases traditional water holes and charco dams are preferred sources. Water from these sources is of poor quality and in most cases highly turbid that obliges women to clarify domestic water using locally available plant materials (natural coagulants).

Among the main issues raised from discussion and interviews pertaining to unsustainable water supply schemes are poor local governance, poor economic situation of inhabitants to contribute to and maintain the village water funds for the operation and maintenance of the water schemes. In addition, the "free water attitude", which is still in the mind of the inhabitants, hinders them from taking full responsibility of the schemes. It was evident from the respondents and dispensary data that water borne diseases are among the most devastating health problems in the study area. It was also observed during the physical survey that 90% of the households in the study area do not have any kind of excreta disposal facility. This condition most possibly aggravates the problem of water borne diseases due to the pollution of water

Table 3: Assessment of Sustainability of Water Supply Sources in the Study Areas

Water source	*Location*	*Coverage*	*Condition*	*Villagers remarks*
Suke dam	Msange village	- Used by all villages in the ward and nearby wards	- Medium size dam. - Working & renovated in 2004, turbid water - Supply throughout the year to most villages.	More charco dams are needed
Borehole	Msange village	- Usually it is used by all villages in the ward	- Rising main worn out - Domestic water point destroyed - Obtain water from the booster tank	- Village Solicit fund for repair - More borehole are needed
Rainwater tank	Msange village	For Msange dispensary use	- Empty in dry season - Small storage tank	- Households can't afford
Mipilo charco dam	Mipilo village	- Used by 3 villages	- Poorly designed - No cattle trough - Turbid water - Silt accumulation - Dries in September to December	- Renovation needed. - More Charco dams are needed.
Nungulu charco dam	Mipilo village	-Used by many villages	- Well designed - Cattle trough included - Renovated in 1998	- More charco dams are needed
Windmill	Mipilo Village	-Used by all villages in the ward and others	- Frequently broken down - No reserve tank - Depends on wind	- Solicit fund to buy spare parts to renovate it.- Reserve tank is needed
a) Endeshi Water holes (WH) or Traditional wells b) Itaja water	a) Nearby ward (Ikhanoda) b) Neaby ward (Ngimu -Mangida village	(a&b) - Supply nearby wards - Water quite clear	(a&b) - Unprotected hand dug well - Flooded in rain seasons - They are very few - Risk of collapse - They are very far	- The government should assist to construct more wells with technical improvements
Mangida charco dam		- No water in the dam	- A new poorly designed reservoir - Rainwater does not flow into it (dry dam)	- Redesign the charco dam -More charco dams are needed
Borehole	Mangida	Pump collapsed and sunk down		- No village water fund for reviving it

sources and inadequate hygienic practices of the villagers. The impact of poor water supply services and poor human excreta disposal on prevalence of water borne diseases in Tanzania and other developing countries has been reported by the Ministry of Health (1999) and WHO (2002). Issues pertaining to insufficient water supply and sanitation facilities do not only affect the quality of life of the people but also have an impact on the government that fail to invest in water supply and sanitation facilities for the poor because it may eventually end up spending much more on health and lost economic activities in the case of epidemic outbreaks (Gutierrez et al., 2003).

Distribution of Preferable Domestic Water Supply Sources for Different Villages in the Study Area

The results presented in Fig. 1 show the distribution of the preferred water supply sources for domestic and animal watering purposes. About 95 to 100% of the respondents obtain water from Suke dam and charco dams; 12 to 22% from the borehole located in Msange village; 10 to 22% from windmill located in Mipilo village; and 20 to 60% fetch water from traditional water holes. The results also show that women are the main domestic water carriers and have preference for multiple water sources, this is influenced by the availability of water from the various sources during different times of the year, the distance to the water source and cost implications. Women in Msange and Mipilo argued that it is better to fetch water from charco

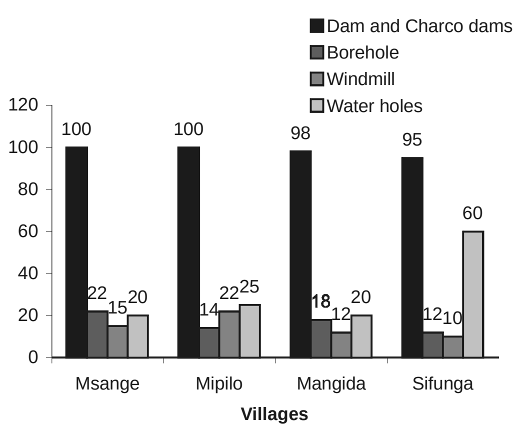

Fig. 1. Percent Distribution of Respondents to Preferred Water Sources

dams which is free of charge and can be easily clarified at home or at the source rather than travelling long distances to unreliable potable water sources and yet paying 20 Tanzanian shillings (US$ 0.02) per bucket of 20 litres. Although traditional sources of water supply such as Endeshi and Itaja wells are located far away in other wards, they are preferred sources for some nearby villages located in Maghojoa ward, especially those that lack any kind of water supply source such as Sifunga and Mangida.

Distances Travelled by Villagers to Water Sources and the Gender Perspective

The results of the survey on the distance covered by the inhabitants to retrieve water from different sources is presented in Table 4. In Msange village where there is one borehole and one dam, about 53% of the women walk 2-3 km to water sources. Similarly, in Mipilo village where there is one wind mill and two charco dams, about 65% of women walk 2-3 km only to water sources. Contrary to this, about 70% and 54% of women in Mangida and Sifunga villages are respectively obliged to walk a distance of 6-7 km because they lack any kind of water supply source. However, the distance travelled by women varies, 5%, 10%, and 11% of women in Mipilo, Mangida and Sifunga walk more than 7 km to water source basically due to financial barriers to buy potable water and the unreliability of potable and traditional sources. The respondents also pointed out that every woman has a budget of 2 to 7 hours in her daily schedule of domestic chores, especially for water fetching and purification and compensating for non-existing excreta disposal facilities. This situation is analogous to that reported by USAID (1984) in the Bolgataga district in Ghana in which 96% of women walk an average of 6.1 km and spent 30 minutes to 6 hours in search of water. The impacts of tight household chores for women on socio-economic and health development of rural communities are reported by (Eliufoo and Marobhe, 1998).

Data from the questionnaire survey and discussions conveyed yet another dimension of fetching water on the basis of sex. It was pointed out that both women and men participate in fetching water. However, it was observed during the discussions that, men use donkeys and animal driven carts to carry water from the various sources for watering calves, occasionally for

Table 4: Analysis of Distance Involved in Fetching Domestic Water Supply

Distance (km)	*Villages/Respondents*							
	Msange Respondents		*Mipilo Respondents*		*Mangida Respondents*		*Sifunga Respondents*	
	No.	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*
0.5-1	7	8	3	4	0	0	0	0
2-3	45	53	47	65	3	6	3	5
4-5	30	35	15	20	7	14	18	30
6-7	3	4	4	6	34	70	31	54
> 7	0	0	3	5	5	10	7	11
Total	85	100	72	100	49	100	59	100

building activities and in very rare cases to supplement domestic water carried by women. It was further noted from the discussions that men actually spend less energy than women in this activity because they neither carry water on their heads nor walk on foot during the transporting of water. Women also pointed out that men usually carry water containers on animal driven carts. The WEO and VEOs however indicated that, households with donkey and cow driven carts are very few. It was noted that on the average only 10 to 15 households in the ward possess these facilities. This situation has health and social repercussions on women in the study area. According to Howard and Bartram (2003) women who happen to be the main water collectors and have to retrieve water from distance sources on regular basis, suffer from severe back problems.

Traditional Purification of Water Fetched from Charco Dams

Physical and Bacteriological Quality of Dam and Charco Dam Water

Based on field survey and physical investigations of water sources, it is evident that water from Msange dam and charco dams are the most reliable and readily available sources for most of the inhabitants in the surveyed villages. Apart from being very turbid, they also have high bacteriological counts (Fig. 2). The average thermo tolerant faecal indicators (Faecal coliforms) in Msange dam, Mipilo and Nungulu charco dams are 900, 1500 and 1100 per 100 ml respectively, while turbidity levels are 2250, 5250 and 3070. The water pH of Msange, Mipilo and Nungulu dams is 6.9, 6.8 and 6.9 respectively, while electrical conductivity is 810, 280 and 240 mS/cm (data not shown). Turbidity of charco during rainy seasons ranges between 1000-1500 Nephelo-

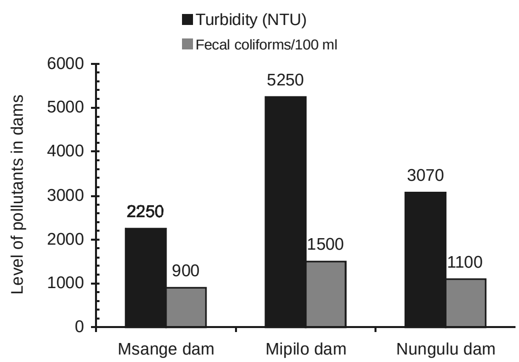

Fig. 2. The quality of water from charco dams in the study area

metric Turbidity Unit (NTU), while that of bacteriological ranges between 10^3 and 10^5 faecal coliforms /100 millilitres (ml).

Local Knowledge for Purification of Turbid Water Sources

Women in the study area clarify turbid waters using powdered seeds from locally grown plants, *Parkinsonia aculeata* trees and wood ashes. It was noted from the discussions and physical observations that about 98% of households in the study area apply traditional methods for purification of turbid water. Other seeds apart from being used as natural coagulants and their performance in terms of turbidity reduction are summarised in Table 5. The seed powder from *Vigna unguiculata*, *Voandzeia subterranea*, *Arachis hypogaea*, *Vicia faba*, and *Parkinsonia aculeata* are used mainly for purification of water for drinking and cooking purposes while wood ashes are mainly used for clarifying water for activities such as laundry, bathing, washing utensils but very rarely for drinking. The results show that seeds that are used in water clarification are also used as local foodstuff and as such are assumed to be non-toxic to humans. However, *P.aculeata* trees are not very commonly grown by people in Singida rural district. Some households in the case study villages use *P. aculeata* as a shade tree and for demarcating farms. Also, the green or flesh pods are chewed by people because of the sugary taste. Moreover, the different types of seeds that are used traditionally for purifying turbid water belong to the family Fabaceae and are also referred to as legumes. Legumes are used extensively as a substitute for meat protein for people in Sub- Saharan Africa (SSA) and in countries where animal proteins are scarce and expensive or are not consumed for religious or cultural reasons.

Procedures and Processes Involved in Traditional Water Purification and the Performance of Seed Powder

Through the application of participatory and interview strategies on women in randomly selected households in Msange village, it was learnt that women fetch water very early in the morning and use coagulation–flocculation process to remove suspended and dissolved matter immediately. The seeds are ground on a special grinding stone to fine powder and kept in plastic bags in dry places for 1 to 2 months for daily use. The 20 litre bucket of drinking water is dosed with 2 to 5 teaspoons (about 20 to 50 grams) of seed powder, while 500 grams to 1 kilogram of wood ashes is used to clarify the same quantity of water for washing and bathing purposes (Fig. 3 and Fig. 4). The water is subjected to rapid mixing speed of about 100-150 revolution per minutes (RPM) and allowed to swirl itself for about 5 to 10 minutes after which the formed flocs are allowed to settle for 20 to 25 minutes. The clarified water is decanted and stored in a clean, usually clay, pot and stored in a cool place for drinking and cooking purposes. On average a household purifies 1 to 3 (20 to 60 litre buckets/day) of drinking and cooking water, depending on the size of the family. The rapid and slow mixing followed by settling (sedimentation) of treated water done by the villagers is analogous to conventional surface water treatment processes that are commonly practised by many countries and during the performance jar tests to determine optimum dosage of chemical coagulants (Gregor et al., 1997; Kiely, 1997).

The results displayed in Table 5 reveal that

Table 5: The Use Patterns of Seeds and Water Purification Potential of Seed Powder

Local coagulants			*Local uses*	*Average dosage of powder used (teaspoon/kg)*	*Average residual turbidity (NTU)*
Common Name	*Botanical Name*	*Family name*			
Field bean	Vicia faba	Fabaceae	- Common food stuff - vegetable soup and stew - Cash crop - Drinking and cooking water purification	3	382 (83%)
Bambaranuts	Voandzeia subterranea	Fabaceae	- Occasional food stuff (vegetable soup & stew) - Drinking and cooking water purification	3	270 (88%)
Green gram or cow peas	Vigna unguiculata	Fabaceae	- Rarely grown cash crop - Drinking and cooking water purification	4	225 (90%)
Groundnuts	Arachis hypogaea	Fabaceae	- Used extensively as food seasoning - Cash crop-Drinking and cooking water purification	2	247 (89%)
Jerry bean tree, wonder tree, Jerusalem thorn.	Parkinsonia aculeate	Fabaceae	- Drinking and cooking water purification - Green pods edible - Fuel wood - Shade tree	4	295 (87%)
Wood ashes	From any tree species and charcoal	-	- Clarification of water for washing, and very rarely for drinking	0.5 – 1 kilogram	247 (89%)

Fig. 3. Women in the process of grinding local seeds. The grinding stone is shared among households

Fig. 4. Members from four households showing the procedure of treating turbid water with seed powder

the performance of local seed powders is remarkable and encouraging. Turbidity removal efficiencies of *V. faba*, *V. subterranea*, *V. unguiculata*, *A. hypogaea*, *P. aculeata* seed powder and wood ashes are 83, 88, 90, 89, 87, and 89% respectively, correspond to the residual turbidity of 382, 270, 225, 247, 295 and 247. The residual turbidity obtained could give an impression that the water is still very turbid and objectionable for drinking. Actually, the treated water appeared milky and no longer muddy but it contained very fine suspended particles that are possibly responsible for the observed high level of residual turbidity. The performance of local coagulant could however be improved by regulating some of the parameters that have been to influence water coagulation reported by many researchers. Such parameters include raw water pH, coagulant dosage, mixing speed and duration and settling time (Schultz and Okun, 1984; Muyibi and Evisen, 1995).

Traditional Coagulants and their Potential in Enhancing Future Development of Rural Communities

The knowledge of purification of polluted domestic water supply sources using locally available seeds has got both direct and indirect ways of improving the quality of life and enhancing sustainable development in rural communities. These developments however cannot be realised unless local knowledge is recognised, promoted and adopted for providing a holistic framework for enhancing social, economic and ecological developments. Sustainable rural development is also a function of interaction of mechanisms that operate at grass root levels, water sector, economic sector and other key sectors. Moreover, scientific and technological community and other phenomena should all work together and provide a platform of knowledge from which future water and other developmental projects might explore new developmental options for the rural people.

It is seen in this study that apart from food crops that have proven to be potential coagulants, *P. aculeata* has got a high potential of enhancing social, ecological, and economic development of people in semi-arid areas. The tree is however very much under-utilised and not adequately publicised by experts as one of the trees that will help ameliorate some of the basic problems in such settings. Apart from being grown by very few households in the surveyed villages, only a few trees stand in scattered manner in the villages.

P.aculeata is a shrubby tree that can reach the height of 10 meters, it grows fast, is drought resistant, easily propagated using seeds that have a hard coating and which allows the seeds to remain viable under harsh conditions. In addition, it has got two flowering seasons and the trees remain green throughout the year. The World Agroforestry Centre outlined the useful function of *P. aculeata* as follows: a) Food - the edible fruit pulp is eaten; it is sweet and contains up to 60% of sugar and foliage and pods are browsed by livestock. b) Agriculture - the large, fragrant, golden yellow flowers easily attract bees. c) Fuel - its wood burns well and is hence suitable for firewood and charcoal production. d) Medicine - leaf, fruits and stem decoctions are used as herbal medicine. e) Services - erosion control, especially in arid areas and in sand soils; it can be used to afforest eroded and sandy soils, gulled areas and reclamation of wastelands; it has strong wood and can withstand harsh winds with ease due to the open growth habit (Drechsel et al., 1989; Gilman and Watson, 1993; Suleiman and Bhat, 2003). Also, it can be used for improving soil organic matter content by providing a large amount of leaf litter on the soil, its browse resistance and thorns make it valuable as a life fence for protecting arable fields in arid and semi-arid areas.

It is important that strategies to encourage the planting of these trees and appraise their use and that of other local coagulants for social, economic and ecological development of rural communities should be worked out. The areas in which the tree has potential to contribute towards sustainable development for the rural poor include:

- Social development: Improved access to reliable water supply through rehabilitation of potable water schemes and other sources that are free of charge (charco dams) that can be purified efficiently using local seeds. The easy planing of these trees will give access to fuel wood, improve the health of the inhabitants, offer them a better potential of meeting basic human needs, ample time to spend on caring for children and conducive weather due tree cover.
- Ecological development: Reduced deforestation (sufficient fuel wood) and land degradation due improved tree planting and improved soil structure and fertility resulting from the decomposition effects of litter from trees and increased land-productivity.
- Economic development: Improved food security, improved production and selling of food and cash crops, improvement of technologies in the areas of water supply, preservation of the environment and new income generating activities such as bee keeping, charcoal production.

CONCLUSION AND RECOMMENDATIONS

Conclusion

The following are the main conclusions from the research:

- Local water treatment knowledge has evolved and propagated among rural populations due to inadequate water supply sources. The current coverage of water supply in the study area is less than 20%.
- The installed potable water supply sources are insufficient and also unsustainable due to, inter alia, poor local governance, poor operation and maintenance of water scheme and insufficient investment by the government in rural water supply.
- About 95-100% of the people in the surveyed villages obtain domestic water supply from the dam and charco dams 20-60% from traditional wells while 10-22% obtain water from the windmill and boreholes. Women are obliged to walk distances of 2 to more that 7 km to different water sources. Gender analysis shows that women spend more energy and time in water collection activities than men.
- The quality of water from charco dams is of very poor quality in terms of turbidity and bacteriological content. 98% of households in the study area purify turbid water fetched from

charco dams using local seeds powder. The performance of seeds could not reach the TTS recommended for drinking water due to a lack of scientific understanding on how coagulants work.

· Local plants that produce seeds (especially *P. aculeata*) for water purification have a great potential of enhancing social, economic and ecological development in semi-arid areas. These challenges can be indirectly redressed through improved domestic water supply, improved social welfare, improved food and cash crop production, diversified income generating activities, reduced land degradation, afforestation of degraded lands and improved soil productivity.

Recommendations

Finally, this paper recommends intensive scientific research on the performance of local coagulants as well as promoting commu-nities in semi-arid areas to plant *P. aculeata* due to its enormous potential contribution to the sus-tainability of rural livehoods. Moreover, the establishment of partnership and collaboration with key sectors, organisations, and local communities coupled with political support in planning and implementation of rural develop-ment projects are crucial.

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KEYWORDS Charco dams; purification; local seeds; sustainability; turbidity; villagers; water

ABSTRACT This paper explores the link between water supply problems and traditional water purification knowledge and how this information could be applied to improve water supply situation and enhance sustainable development in rural communities. Questionnaires, focus group discussions and participatory approaches were used to capture information on the water supply situation in Singida rural district. The findings show that potable water supply coverage in the study area is less than 20% due to malfunctioning water schemes. About 95 to 100% of households in the study area obtain domestic water supply from rainwater reservoirs, 10–22% from boreholes and windmills and 20 to 60% use traditional wells. Up to 70% of women walk a distance of 6-7 kilometres to various water sources. Turbidity and bacteriological content of water from rainwater reservoirs range from 2250 to 5250 NTU and 900 to 1500 faecal coliforms per 100 millilitres respectively. Prevalence of water borne diseases is due to consumption of polluted water. The performance of seeds from different local plant species on turbidity removal was analysed. About 20 to 50 grams of seed powder were used to clarify 20 litres of turbid waters. Turbidity removal efficiency after mixing and sedimentation ranged from 83% to 90%. Local coagulants can enhance sustainability of rural life by improving access to potable water supply and fuel wood, land productivity and afforestation. The paper recommends that traditional knowledge can provide a holistic framework for water sector reforms and the planning and implementation of development projects to enhance sustainable economic, social and ecological development.

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