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The WRC operates in terms of the Water Research Act (Act 34 of 1971) and its mandate is to support water research and development as well as the building of a sustainable water research capacity in South Africa.

TECHNICAL BRIEF

Rainwater harvesting

Assessing the social and economic acceptability of rainwater harvesting and conservation practices

The WRC funded a study aimed at evaluating the social, economic and institutional determinants of sustainable rainwater harvesting and conservation (RWH&C) techniques and practices in selected communities.

Background

In South Africa, large numbers of households, particularly in rural areas, lack access to adequate and clean water for agricultural production and for domestic use and sanitation. For millennia, societies have used various rainwater harvesting techniques to provide water for domestic use and agricultural production. Over the years many new rainwater harvesting techniques have been developed and some traditional and indigenous techniques modified and improved.

Rainwater harvesting is the purposeful collection of rainwater from various catchments such as roads, hillsides, pastures and within fields; and rooftops and the storage of such water in physical structures or within the soil profile.

Rainwater harvesting-related research

The WRC has funded research on rainwater harvesting for 15+ years. The latest report is based on work carried out under a research project initiated by the WRC with the aim of understanding influencing decisions of households in varying locations to adopt and the choice of rainwater harvesting techniques, the decision to keep using or dis-adopt the techniques.

The study was carried out the peri-urban villages of Potsane, in the Free State, and Kwezana-West, in the Eastern Cape. For comparison, the more isolated or deep rural location of Rietfontein, Free State, and Cata Eastern Cape, were selected.

A homestead gardener preparing her basins for the new growing season.

In the Free State, many households had pits in their homestead gardens for collecting runoff from the road. None of the households were using the water collected for either domestic purposes or crop production, and in most instances these pits were filled up with sediment. About 30% of households were engaged in homestead garden production activities using in-field rainwater harvesting introduced by researchers from the Agricultural Research Council. Only a handful of households collected and stored water from rooftops.

In the Eastern Cape, about 20% of the households in Cata employed deep trenching to produce various vegetable crops. Several households practised rooftop rainwater harvesting, mostly to provide water for domestic use. Another handful of households had brick and cement water storage tanks for storage of road and hillside runoff.

It was surprising that few households exploited rainwater harvesting to help meet their water needs, even though water availability was considered a problem. Reasons for not engaging in rainwater harvesting included lack of financial and labour resources to put up rainwater harvesting structures.

In the four selected villages, households that engaged in production of maize, beans and other vegetable crops using rainwater harvesting techniques reported food security and nutritional gains and, in some cases, were able to earn extra income from the sale of surplus produce. Economic evaluations of the rainwater harvesting techniques also suggest that households can earn a positive and substantial net return to the investments in rainwater harvesting structures.

While the use of rainwater harvesting has the potential to contribute to water supplies and food security, the predominance of older people (especially older women) among the practitioners of the technique does not bode well for their continued use by households in these areas. The youth in all four villages generally show lack of interest in involvement in agriculture. When the older people are no longer able to continue making and maintaining rainwater harvesting structures, the practices are not continued as knowledge is not passed down to the younger generation.

Many households who would otherwise benefit from rainwater harvesting lack the knowledge of the best techniques suites to their areas and purposes, as well as the resources and technical expertise for the construction of the systems. There is need for the provision of information in user-friendly formats to be made available to potential adopters. Agricultural extension and community development agents need to be equipped with the necessary skills to enable them to promote the adoption of rainwater harvesting and to provide technical advice to households.

Research findings

Biophysical characteristics of RWH&C and adoption by households

Community members employed various RWH&C practices in their homestead gardens. The in-field rainwater harvesting (IRWH) technique is used by a few community members in Potsane and Rietfontein while community members from Cata predominantly use trench bed gardening for homestead vegetable production.

Roof and road water harvesting is also practiced by community members in Cata and Kwezana-West. However, water collected this way is mostly used for water for livestock and for supplemental irrigation in homestead gardens.

Research and field observations over five years since the onset of the project have shown that the RWH&C practices can increase production considerably compared to the old conventional ways of production. However, the full potential of these techniques has not been realised yet as a result of poor husbandry practices of households, e.g. non-use of fertilizers, poor weed, insect and plant diseases control.

Results from experimental and farmers' fiel trials over the past decade have shown that IRWH:

- Increased crop yields between 20% to 50% as compared to conventional cultivation (CON) under experimental conditions
- Decreased the chances of crop failures between 60% to 80% compared to CON
- Conserved the natural resources far better than CON in terms of conserving the soil water content and therefore increased plant available water, reducing ex-field runoff and therefore erosion
- Conserved the carbon content in soil far better than CON due to its no-till and minimum tillage effects
- Increased the good micro- and macro-organisms due to its no-till and minimum tillage

Therefore, taking the relevant parameters into consideration that affects sustainability from a biophysical perspective it can be concluded that scientifically proven RWH&C practices, such as IRWH are agronomical and environmentally sustainable.

Socio-cultural dynamics and adoption of RWH&C in Thaba Nchu and Amathole District

In order to understand the social dynamics within communities the WRC investigation focused on issues such as the nature of social support (internal and external), the strength and scope of social networks, the obstacles in social cohesion, as well as the role of leadership in enhancing cohesion.

The most significant findings regarding these areas are that the youth should be included in community-based projects because it could have implications for the social cohesion within a community; that the participating women are mostly socially vulnerable and need continuous external support; that the internal social networks provided a safety net, but that they are structured around poverty and scarcity, which induced relationships of dependency; and finally that there is a growing uncertainty regarding the roles and powers of local village and/or tribal leaders within the present dual system at local government level. This situation could have a negative impact on the successful adoption and continued use of agricultural innovations.

Human capital development and adoption of RWH&C practices

It is apparent that impoverished households, drastically reshaped by intensified patterns of out-migration and, in fact, its growing 'permanence', particularly in the Eastern Cape, means that the growing reality is permanently migrated households of absence.

This, in turn, entails that the very households that one is seeking to encourage to develop as more commercial producers are themselves unable, unwilling and uninterested in making these transitions, despite very high levels of impoverishment and food insecurity. Migration is a key factor in determining this, and the very 'presence of absence' in practically every household does this on a daily basis.

When looking at the community and the households, and their networks, the informal sense of involuted economies, impoverishment, and the resultant real limitations of reading a linear notion of human capital development onto the communities were observed.

Economics of RWH&C for vegetable and field-crop production

The investment appraisal of all the RWH&C techniques showed that they are worth investing in as they had positive benefit cost ratios and net present values. Access to both input and output markets is a challenge for the adopting households, thus there is a need for efforts to improve access to the market for both inputs and output. However, efforts must be creative as the challenges may not be addressed by the traditional methods of improving access to input and output markets owing to the small amounts of outputs and inputs characteristically required by the home garden producers.

Institutions and support infrastructure

In terms of specific infrastructure for the RWH&C practices, most households have been able to fully construct the requisite infrastructure, mainly labour dependent and most of the purchased infrastructure was provided through project funds either by government, parastatals and non-governmental organisations. This includes rooftop rainwater harvesting tanks plus the plumbing, and gardening tools.

The dependence on external support to acquire infrastructure, even for rainwater harvesting, may further engrave the dependency syndrome but it should be noted that most of the garden producers would otherwise not be able to generate or mobilise the necessary cash income required to purchase the infrastructure. However, those not benefiting from the project might be discouraged. While technology-specific infrastructure has been provided, there is still a need for more infrastructure for post-harvest purposes, such as storage facilities for the smallholder farmers to store their produce, especially perishables, such as vegetables.

Synthesis

All the five capitals (natural, physical, financial, human and social) turned out to be important for the sustainable adoption of RWH&C practices and techniques. Each capital must be known and evaluated on its own and then in conjunction with all others, taking characteristics, adequacies, limitations etc. into consideration.

The natural capital (soil, climate etc) must, for instance, as a point of departure, be suitable for implementing specific RWH&C practices and techniques. If this is not the case it is not worth the while to try and implement it.

In three villages, Potsane, Riefontein and Cata, the natural capital is fairly good, while in Kwezana-West the lower annual rainfall is, for instance, a constraining factor in the application of some of the RWH&C techniques.

Next, the physical capital must be evaluated to determine

adequacies, limitations, etc., followed by describing/knowing, analysing and evaluation of the financial, human and social capital.

Although each capital on its own is very important, like shackles in a chain, the interactions among all capitals are also very important, and must be known to identify competitive, supportive and synergistic relationships. In this regard the human and social capitals play an overarching role, but are relatively more complex than the other capitals, as well as very difficult to understand, assess and evaluate.

The report ends off with guidelines of factors and issues that must be considered with regard to the different capitals before venturing into the promotion of RWH&C practices in other areas.

Further reading:
To order the report, ***An assessment of the social and economic acceptability of rainwater harvesting and conservation practices in selected peri-urban and rural communities*** (**Report No. 1648/1/12**) contact Publications at Tel: (012) 330-0340, Email: orders@wrc.org.za, or Visit: www.wrc.org.za to download a free copy.