Can Drip Irrigation Improve Food Security for Vulnerable Households in Zimbabwe?

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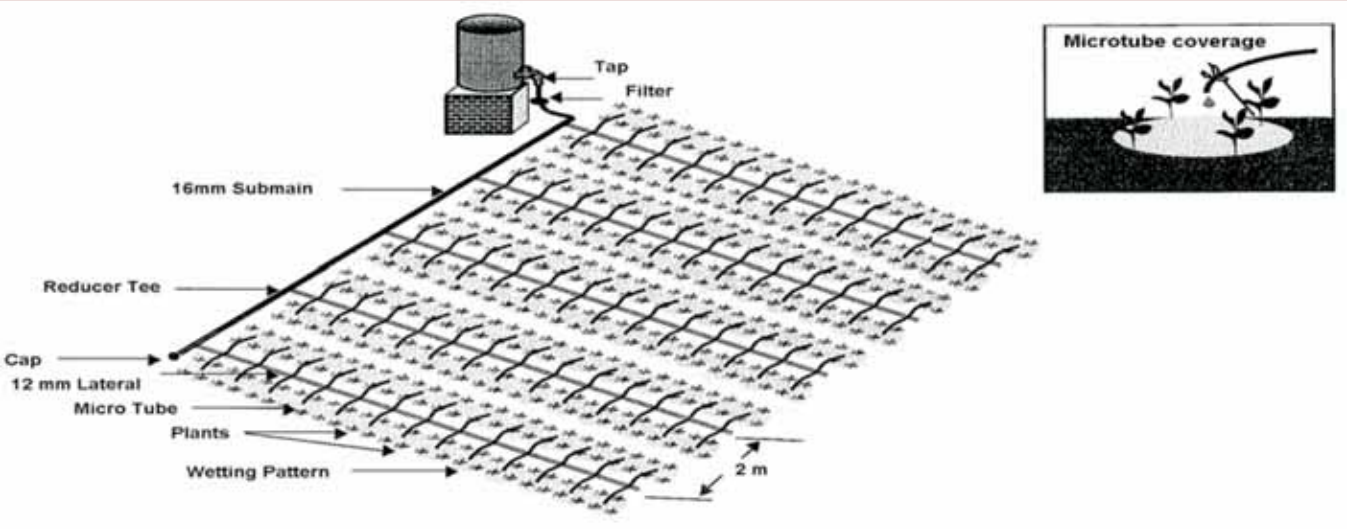
Background

Drought relief programs have been implemented almost every other year since Zimbabwe's independence in 1980 as smallholder farmers frequently face dry spells that significantly reduce production levels and compromise food security. The use of micro-irrigation technologies, notably small-scale drip irrigation kits, has become an area of growing interest and investment (Box 1).

Since 2002, more than 70,000 low-head, low-cost drip irrigation kits have been distributed in Zimbabwe with the aim of improving household food security and nutrition and where possible increasing income through the sale of surplus products. The relief programs targeted vulnerable households that faced acute hunger from one season to the next and were affected by HIV/AIDS. Drip irrigation kits were introduced with variable management strategies and training.

Box 1

The term 'micro-irrigation' refers to drip, trickle, spray, micro-jets or mini-sprinkler systems designed to use available water more effectively. Micro-irrigation is a localized irrigation method that slowly and frequently provides water directly to the plant root zone via emitters. In the last decade, the concept of drip irrigation has been adapted to small plots that can be handled by a single household. Small-scale drip irrigation systems typically use a bucket, drum or barrel, connected to a filter and a system of pipes, laterals and emitters. Crops are planted according to the emitter positions on the laterals. The water containers have to be elevated above the field to create the necessary head pressure to enable water release at all emitter points.



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While some of these programs appear to have had positive payoffs, questions have arisen about the level and sustainability of these gains, particularly in the context of large-scale relief. For example, in one small study of drip irrigation systems, only 2% of the households that received a drip irrigation kit (hereafter called 'beneficiaries') consistently used the kits over five consecutive seasons (Moyo et al. 2006). Some of the problems that led to discontinued use included a lack of access to water, clogging, and poor training in systems maintenance and use. In some communities, conflicts developed over water access rights. These limited survey results stimulated the drafting of a protocol on the distribution and use of drip irrigation kits (DFID 2005). However, more information was needed to assess the extent of such difficulties and their implications for continued investment in building micro-irrigation infrastructure as part of sustained relief initiatives in the region.

Some other related questions include whether or not the drip kits benefited the poorest and most vulnerable farm households as well as the cost-effectiveness of drip irrigation compared to traditional micro-irrigation technologies such as buckets. Using buckets may require more water per unit of crop production but it appears to be simpler and more appropriate than the drip kits for many households with limited gardens.

A country-wide study in 14 districts covering both high and low rainfall areas was undertaken in 2006 to assess the impact and sustainability of drip kit distribution programs in relation to water availability and access, as well as the targeting of beneficiaries. Higher rainfall areas are those in Natural Regions I, II and III, and the drier parts constitute Natural Regions IV and V.

Use of drip kits

Most beneficiaries tried the drip kits for at least one full cropping season following their distribution, but stopped using them within a year or two (Figure 1). The lack of adoption is clearly evident as a function of time since distribution. After two years, only about 1/3 of the kits that had been distributed were still being used, and after three years this number dropped to about 1/6 of the kits. As expected, kit use was lower in the wet than in the dry season. The adoption pattern was similar in high and low rainfall areas.

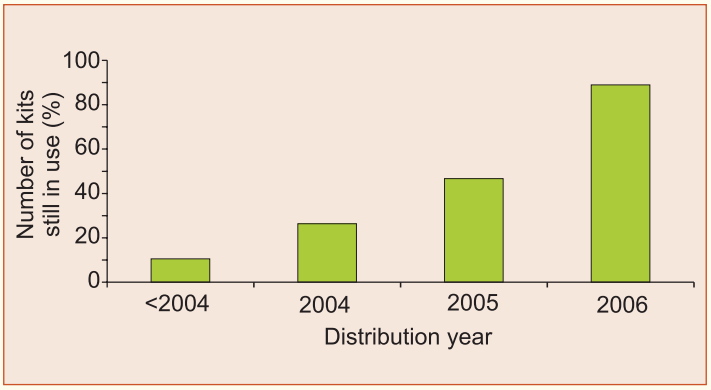

Figure 1. Utilization of drip irrigation kits by year of distribution in dry season of 2006 (N = 232)

In almost all cases, farmers supplemented the drip irrigation with buckets. Quantitative data on water use showed virtually no difference between plots where kits were laid out and plots that were entirely watered by hand. Therefore, most households did not achieve the water and labor savings that are often claimed as the main benefits of drip kit irrigation.

Nutritional benefits

The distribution of drip kits was usually justified as a means of improving the nutritional status of vulnerable households by encouraging the production of vegetables. Yet 90% of beneficiaries already had established vegetable gardens using bucket irrigation. The survey data indicates that there was neither an increase in the range of crops grown, nor any increase in the volume of production when people received a drip kit. In fact, and somewhat surprisingly, the range of crops grown under established gardens watered with buckets was higher than gardens with drip kits. Almost all households, irrespective of method of irrigation, grew tomatoes, rape, cabbage and onions. The fraction of people who were able to market their produce was higher among non-beneficiaries than beneficiaries, partly because beneficiaries abandoned the kits.

Targeting

Every program of drip kit distribution clearly states that it targets vulnerable households. But beneficiaries were only slightly more vulnerable in terms of household members being infected by HIV

and were sometimes even slightly wealthier in assets than non-beneficiaries.

Is a drip kit suitable for vulnerable households? To operate the drip kit, users have to lift water into the container, which is, in most cases, at least 1.5 m and sometimes even more than 2 m above the ground. This task requires considerable strength and cannot be performed by sick farmers or children. Moreover, vulnerable people are not likely to adopt technologies that increase labor, are risky and relatively complex.

Water availability

Water availability is essential to the success of any type of irrigation. The Protracted Relief Programme (PRP) protocol prescribes distributing kits only to households with gardens that are within 100 m of a water source. If this is not the case, a wheelbarrow or oxcart should be provided as well. Around 75% of beneficiaries had a perennial water source within 100 m of their garden (Figure 2). Beneficiaries in the wetter regions were, on average, closer to a water source than those in the drier parts of the country. The proportion of people carrying the irrigation water on their heads or by hand decreased with distance, but for distances greater than 250 m more than 50% of the people still carried the water by hand or on their heads. In fact, 80% of households in both regions obtained their water by hand – carrying buckets from the water source to their garden plots. Less than 14% of respondents used either a wheelbarrow or an oxcart.

Around 20% of drip kit beneficiaries indicated restrictions on water access either because of limited availability or because of community restrictions.

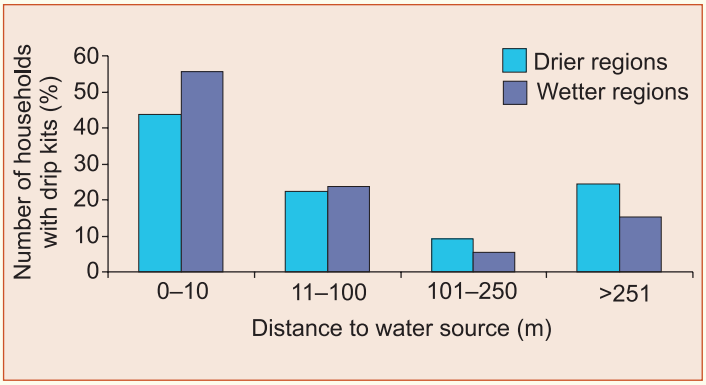

Figure 2. Distance to water among households with drip kits, 2006

The beneficiaries often had to fetch their water from much further away, up to 6 km in some dry areas, and in many such instances drip kits were abandoned because the amount of water required was too much.

Lack of understanding and follow-up

Despite the fact that most drip kit distribution programs included a training element, 60% of households indicated a need for additional advice and support. Typically, the distributing NGO arranged a demonstration where beneficiaries were instructed on how to set up the kit, the principles of irrigation practice, kit maintenance, how to deal with blockages, and crop production practices. Almost 90% of households received this basic training, with less than half this number receiving additional follow-up visits by either NGO or Agricultural Research and Extension (AREX) staff to discuss the use of the kit in the beneficiaries' garden. AREX workers were directly involved in fewer than 10% of the formal group training sessions, resulting in limited sources of information on resolving problems once the NGO's program was completed. Most of the remaining households received follow-up advice from other farmers in the community.

The majority of households interviewed stated that they required additional advice on crop production practices and assistance with maintaining the kits, resolving blockages and the principles of irrigation practice.

Better ways of improving food security

If the potential saving of water and labor are not achieved with drip kits, then buckets are a more cost-effective technology. Since the majority of beneficiaries only managed to save small quantities of water, they are better assisted in other aspects of gardening such as:

1. more use of indigenous crop species,
2. improved nutrient and pest management,
3. training NGO and AREX in gardening, and
4. water resources development.

More use of indigenous crop species:

Many of the vegetable seeds that were provided to farmers are not very well adapted to the

agro-ecology of Zimbabwe. Breeding efforts in other regions of Africa and Asia have produced vegetable species that are better adapted to warmer climates. Another option is to consider crops that need less water and are still nutritious such as cassava, potatoes, and amaranth.

All these as well as other indigenous and more 'tough' crops require less water, reducing the often arduous task of watering. These tougher crops also often require less expensive inputs such as pesticides and inorganic fertilizer.

Improved nutrient and pest management: Pests and soil nutrient deficiencies cause large reductions in yield and thus limit food supplies. Knowledge about proper pest management, however, is not widespread. Soil fertility can be amended by applying manure, crop residues or other types of organic material. Inorganic fertilizer can also be used, but is an expensive input which tends to be over-applied in vegetable plots, causing greater susceptibility to pests and leading to toxic levels in leafy vegetables.

Training NGO and AREX in gardening: Well-trained extension officers and NGO staff may overcome many of the shortfalls in knowledge on the above-mentioned problems. For any type of advice on gardening, local conditions need to be taken into account.

Water resources development: In some areas, vegetable production is nearly impossible due to lack of water or poor quality of the water source.

The saturated soil surface and the disconnected pipe are give away signs of buckets being used.

In these areas, households would be best assisted by development of water resources. This development, however, should take into account all the potential uses – livestock, domestic and crops.

References

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