Technical Brief

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Can drip irrigation help farmers to adapt to climate change and increase their incomes?

Results from the 'Supporting investment decisions in water and land management across the rural-urban continuum in the Volta - Niger focal region' project

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DRIP IRRIGATION FARMING IN KOUDOUGOU, CENTRAL BURKINA FASO. PHOTO: BEDRU BALANA

The economy of Burkina Faso, which has a projected population in 2016 of just over 19 million, is predominantly based on agriculture and livestock rearing. Both of these activities are highly dependent on rainfall. Rainfall patterns across much of the country however can be erratic and are often unevenly concentrated, resulting in short term floods in some areas and extended droughts in others. As elsewhere in West Africa, in many of the years since the 1970s Burkina Faso has experienced reductions in annual rainfall matched by longer and more frequent droughts and in recent years bigger extremes of rainfall variability. This has had significant impact on water resources. Consequently, farmers and livestock herders in many parts of the country are simultaneously faced with the challenges of reduced incomes, lower productivity and food insecurity.

In order to combat some of these challenges, many farmers are now engaged in market gardening vegetables in the dry season as a way of generating an additional household income stream outside of the rainy season. However, access to sufficient water to effectively support

KEY RECOMMENDATIONS

- Support farmers in ways that enable them to invest in new technologies
- Establish a flexible grant system aimed at women and youth groups to provide them with credit to buy drip irrigation equipment
- Improve linkages between producers, markets and consumers by creating and strengthening value chains and facilitating the flow of produce from drip irrigation farming
- Expand the awareness, understanding and use of drip irrigation technology nationally by initiating and promoting relevant extension activities such as the creation of drip irrigation fed vegetable garden demonstration sites in each region

iDE Burkina Faso

IWMI International Water Management Institute

WASCAL West African Science Service Centre on Climate Change and Adapted Land Use

these activities remains problematic, despite efforts by government, NGOs and others. So what can be done to improve smallholder farmer's access to the water they need to make the most of opportunities in profitable vegetable market gardening? What agricultural water managment technologies and practices could be promoted and used more widely by farmers to help them to adapt to the impacts of climate change, stimulate improved household incomes and enhance food security? And how can these technologies and practices be best supported for maximum positive impact?

One answer lies with drip irrigation technology. Although introduced into Burkina Faso during the 1980s, the adoption of drip irrigation by farming communities has been very slow and most have yet to fully realise the benefits. Used correctly and supported effectively drip irrigation has the potential to make a contribution to household incomes, help reduce food insecurity and assist communities adapt to the impacts of climate change while at the same time not threatening the ecosystems and ecosystem services that these communities rely on.

About drip irrigation

Drip irrigation is a way of supplying water in frequent small amounts to the exact place where crop plants can use it, the root zone, through a system of plastic pipes and associated kits. Importantly it improves the precision of water application which helps conserve a number of resources while generating better returns for the farmer's business activities. These kits work using low water pressure and can be effectively used for localized irrigation on small plots from a few square meters to up to 500 m² (as promoted by iDE Burkina Faso). Drip irrigation kits consist of a water tank, main pipes (16 mm diameter) with valves, a filter, and a series of secondary pipes (1m density) fitted with drip emitters (1.2 mm diameter and 40 cm density).

The system requires very simple and inexpensive maintenance, involving periodic cleaning of the filter component to prevent the drip emitters from getting blocked. A water tank of 1000 liters will empty in approximately 15 minutes covering a 250 m^2 plot, with an irrigation efficiency of up to 90%. Depending on crop type, root depths, soil type and weather conditions the exact water application methods may differ. For example, with similar soil and rooting conditions a 250 m^2 lettuce plot in Sudano-Sahelian weather conditions (Ouagadougou) requires 600 liters of water per day (for the crop development stage), compared with 900 liters per day in the Sahel (northern Burkina Faso). For tomato the equivalent water requirements would be 750 and 1125 liters per day, respectively.

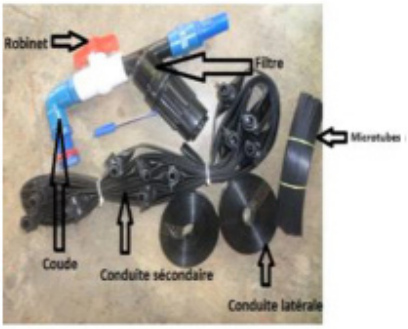
Compared to the other irrigation technologies (hand-bucket, watering can or sprinkler) drip irrigation can result in labour and energy savings and a water saving of up to 30%. It also provides many other advantages such as: increases in crop yields, and a significant decrease in diseases and bleaching since water is not applied to the foliage.

Research methods and approach

The research team used a variety of field investigation techniques to obtain relevant data on use of, constraints to, and the potential for development of, drip irrigation in Burkina Faso. Representatives from government ministries, equipment and input suppliers, NGOs operating in the sector, technical agents, microcredit institutions and women and men farmers from four provinces (Boulkiemdé, Gourma, Kadiogo and Sanguié) were involved. Survey questionnaires, key informant interviews and focus group discussions formed the principle research methodologies. The interviews and discussions resulted in compilation of extensive and detailed information on vegetable farming and marketing in these areas. For example, the main crop types used, the average crop duration, crop yields, market prices for these crops, and the number of crop cycles possible within a year. The data was then analyzed using the SPSS16.0 and Microsoft Office Excel 2016. ArcView 3.2a and Arc Gis 10.1 software were

COMPARED TO THE OTHER IRRIGATION TECHNIQUES DRIP IRRIGATION CAN RESULT IN A WATER SAVING OF UP TO 30%. PHOTOS: IDE BURKINA FASO

Drip irrigation water tank



Drip irrigation kits

Crops irrigated with a drip irrigation kit

used in developing spatial maps of the data collected. This data set then formed the basis for assessing the cost-effectiveness of drip irrigation for various vegetable crops under different environmental conditions and plot size scenarios.

Results and conclusions

Drip irrigation has the potential to improve the livelihoods of smallholder farmers and reduce food insecurity in Burkina Faso. Research conducted in this project reveals that the key barriers to adoption of drip irrigation technology by smallholder farmers in Burkina Faso include:

- High price of drip irrigation kits
- Difficulties in accessing loans or other forms of credit to buy drip irrigation kits
- Difficulties of bringing irrigated agricultural produce to market and consumers quickly and effectively, due to gaps in the value chain
- Lack of awareness and understanding of drip irrigation technology, its potential benefits, and lack of knowledge of how to use it
- Women and youth, in particular, not having adequate access to land suitable for drip irrigation agriculture

The first barrier in particular was mentioned by all respondents of the surveys, both men and women.

Lettuce, which has a very short growing cycle, offers the potential for six cultivation cycles a year in Burkina Faso under drip irrigation. Assuming adequate water supply, a 250 m^2 farm plot of lettuce grown in this way is calculated to able to produce an anuual gross income of US$ 2,581. Tomatoes grown on the same plot size, with three potential cultivation cycles a year under drip irrigation, could result in US$ 4,376, and likewise pepper, with 2 potential cultivation cycles, could result in US$ 2,431. These projected incomes take into account a number of investment and input costs. Investment costs (to secure the site, installation of irrigation systems, a borehole and a water tower) for a pilot drip irrigation site of 1,400 m^2 (shared by a number of smallholder farmers) were estimated to be US$ 11,067. Annual input costs of seeds, fertilizer, disease and pest control and labor were estimated to be US$ 1,597. Annual depreciation of the assets was estimated to be US$ 1,293. The total annual net profit from this size of drip irrigation system investment was therefore estimated to be US$ 12,021, when other costs such as marketing, transaction and transportation costs were taken into account. These costs and profits would need to be shared appropriately among the smallholder farmers involved.

DRIP IRRIGATION SYSTEM POWERED BY SOLAR PUMPS / PHOTO: ADAM ÖJDAHL /IWMI

In order for the adoption of drip irrigation to be successful a number of elements need to be in place. For example, an effective, market-driven distribution network and ongoing technical support that includes both the technology itself and other linked aspects such as agronomic support specific to growing irrigated vegetables successfully.

Key actors in drip irrigation in Burkina Faso

Research results indicate that production using drip irrigation is currently predominantly a male activity. Of those currently using drip irrigation technology 78% are men (only), 13% are women (only) and the remaining 9% are a mix of men and women using the technology together. So a significant opportunity exists to expand not only the use of drip irrigation generally but the use of it by both women and men farmers. A number of key actors, involved in drip irrigation, were identified by the study. These include: governmental institutions, equipment and input providers, traders, installation technicians, microcredit institutions and farmers.

The study identified two drip irrigation distribution models in operation in Burkina Faso. One has been developed by IDE Burkina Faso, which includes job provision related to the technology and allows wide distribution of it. Another, more commercially focused model, is one that has been developed through private sector collaboration.

Implications

Currently, drip irrigation is underutilized in Burkina Faso but potential exists to foster further adoption of this technology among rural farming communities.

Support farmers in ways that enable them to invest in new technologies for example by establishing a flexible grant system aimed at women and youth groups to provide them with credit to buy and maintain drip irrigation equipment.

The results of this research demonstrated that the high cost of drip irrigation kits may

be one of the leading reasons why small holder farmers in Burkina Faso are unable to adopt and use the technology. Supporting farmers to invest in new technologies would enable them to enjoy improved incomes and food security.

Improve linkages between producers, markets and consumers by creating and strengthening value chains and facilitating the flow of produce from drip irrigation farming.
Many farmers, and others working with them, highlighted the difficulties they face in bringing irrigated agricultural produce to market quickly and effectively. These difficulties result in significant losses which have a big impact on the financial returns from, and viability of investment in, drip irrigation cash crop farming.

Expand the awareness, understanding and use of a range of irrigation options nationally by initiating and promoting improved, relevant extension activities such as the creation of irrigation fed vegetable garden demonstration sites in each region. The research revealed that a considerable lack of awareness of, and understanding about, irrigation technologies and their potential benefits still exists among many key actors, particularly the farmers themselves. If farmers are supported in developing the knowledge and skills required to operate and maintain various effective irrigation systems on their farms, and each system's specific advantages and disadvantages it is likely that this would have a significantly positive impact on their productivity, incomes and food security.

Further information about the project

- http://www.wascal.org/research/core-research-programme-phase-1/further-projects/invest-in-water/

Acknowledgements

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http://www.cgiar.org/who-weare/cgiar-fund/fund-donors-2

ABOUT WLE

The CGIAR Research Program on Water, Land and Ecosystems (WLE) combines the resources of 11 CGIAR centers, the Food and Agriculture Organization of the United Nations (FAO) and numerous national, regional and international partners to provide an integrated approach to natural resource management research. WLE promotes a new approach to sustainable intensification in which a healthy functioning ecosystem is seen as a prerequisite to agricultural development, resilience of food systems and human well-being. This program is led by the International Water Management Institute (IWMI), a member of the CGIAR Consortium, and is supported by CGIAR, a global research partnership for a food-secure future.

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