Irrigation Water Measurement Evaluated

With effective measurement of irrigation water, farmers will not only contribute to efficient use of South Africa's water resources, but increase their competitiveness in the market. Lani Holtzhausen reports.

The increased pressure on South Africa's water resources has made water demand management everybody's business. With more than half of South Africa's water used by irrigated agriculture, there is huge pressure on farmers to increase the efficiency of their systems.

According to the Department of Water Affairs & Forestry (DWAF), while the social and economic value of agriculture, especially in rural areas, is recognised, the volume of the country's water resources dedicated to this activity cannot be ignored. Agriculture has a demand of more than 60% of total water use and, says DWAF, efficient use of water by the sector has the potential to play a significant role towards making more water available for use not only within the agricultural sector itself but also for other sectors.

Not all of the water abstracted for use through conventional irrigation methods reaches the root systems of plants. It is estimated that water losses through current irrigation practices range between 30% and 40%. This is currently being investigated.

An unaccounted proportion of irrigation water returns to the river systems by overland flow and return seepage. This return water can be nutrient enriched and polluted with herbicides, pesticides and other pollutants that can detrimentally affect the water quality of the receiving river systems, including possible salinisation downstream.

RESPONSIBLE USE

The country's water laws stipulate that water user associations (WUAs) are responsible for supervising and regulating the distribution and use of water from a water resource according to the relevant water use entitlements by erecting and maintaining devices for measuring and dividing, or controlling the diversion of the flow of water. The WUA must also show that it is making progress towards measuring the quality and quantity of inflows and outflows, losses and water supplied to its customers, and towards the use of acceptable measuring devices or techniques. Since farmers are members of WUAs, water measurement on farms and irrigation schemes will benefit farmers individually and collectively.

But the law is not the only reason to install measuring devices. A recent project funded by the Water Research Commission (WRC) shows that there are also benefits related to practical water management, including accurate accounting and good records which help allocate equitable shares of water between competitive uses. Moreover, it provides the farmers with the information needed to achieve the best of irrigation water while reducing negative environmental impacts. By reducing their cost of water as an input, farmers can also compete more readily with other producers in today's global market.

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In addition there are financial incentives for the WUA concerned, comments Isobel van der Stoep, one of the researchers on the three-year project, which was undertaken jointly by the University of Pretoria's Department of Civil and Biosystems Engineering, the Agricultural Research Council's Institute for Agricultural Engineering and Pretoria firm NB Systems. "If a measuring system is implemented, accounting for individual water used combined with pricing policies that penalise excessive use is possible. The combined result at WUA level can improve the operation and cost-recovery of the organisation, and also put it into a strong bargaining position with higher organisations, such as catchment management agencies."

Dr Gerhard Backeberg, Director: Water Utilisation in Agriculture, at the WRC, reports that the last comprehensive report on water meters in South Africa was published by DWAF in 1986. Since then many changes have taken place, e.g. policy, marketing, and technological environment in which farmers take decisions.

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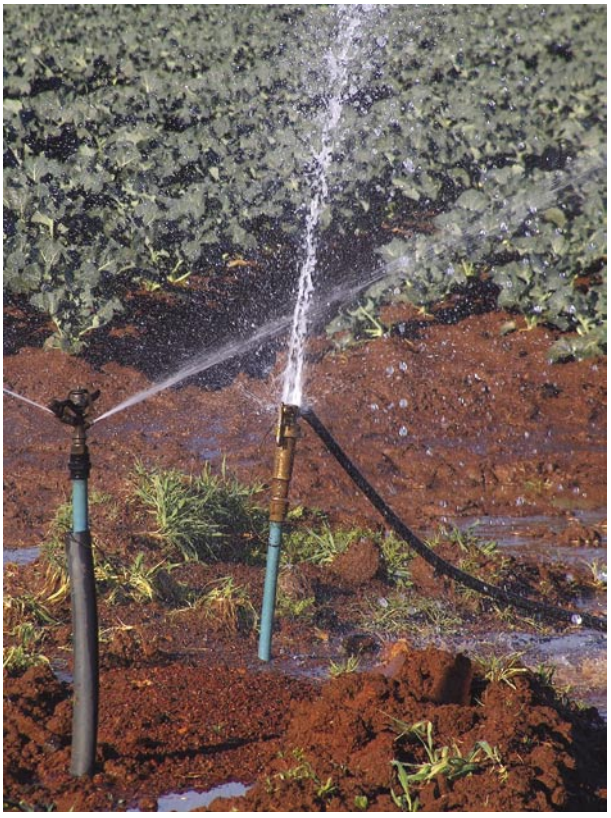

Water losses through current irrigation practices range between 30% and 40%.

He points out that the perception that irrigation farmers in general are wasting water is incorrect. "In any case, due to increases in water tariffs and other costs related to over-irrigation, such as electricity and fertilizer, farmers who waste water will not survive financially

SAVING WATER A CHALLENGE FOR SMALL FARMERS

Irrigation water loss remains a dilemma not only in South Africa, but abroad. Research shows that internationally, the average on-farm distribution losses are 15% and on-field application losses 25%.

While South African farmers compare favourably with these figures, it is believed that improvements to reduce wastage can still be achieved in practice. One way in which to do this is through irrigation scheduling.

A Water Research Commission (WRC) funded project on implementation of irrigation scheduling, completed by the University of Pretoria, found that the majority of smallholder farmers do not perceive irrigation scheduling as an important production constraint. "These farmers are preoccupied with persisting barriers to progress, including lack of credit, infrastructure and access to markets, insecure land tenure, vandalism and theft, as well as inadequate extension support," Dr Gerhard Backeberg WRC Director: Water Use in Agriculture, points out.

"These findings show that the situation facing emerging and subsistence farmer is diverse and complex. Given the necessity of including these farmers in the main stream of the economy, must more must be done to assist the farmers by all organisations which can provide support."

In this regard, the WRC has made a significant shift in funding of appropriate research projects to the benefit of smallholder irrigation farmers. These include participatory development of training material, determining best management practices for small-scale farmers, investigating different farm ownership models and support structures, approaches for establishment of profitable small-scale farming and guidelines for revitalisation of irrigation schemes.

because of the narrowing profit margins. Furthermore, from the release of water at the dam wall to the application of water at the root zone, the farmer can only directly control wastage after water has been received at the sluice on the farmer border."

WATER MEASUREMENT IN PRACTICE

Van der Stoep reports that the WRC project was launched in 2000 to review the current situation and needs in the field of irrigation water measurement in South Africa. Extensive field trips were undertaken to identify which measurement technologies were currently being used and which were most effective.

Through its investigations the project team found that there are still many unanswered questions around irrigation water measurement, especially on the policy and legislative side. "WUAs and farmers are concerned over the lack of clear guidelines and directives from DWAF. While water measuring is considered a best management practice, there seem to be no clear guidelines from government on how it should be implemented," notes Van der Stoep.

There are also concerns surrounding the issuing of water use licences (by when will they be issued), improved bulk measurements in rivers (typically at gauging stations) as well as required measuring accuracy should metering at farm level become mandatory. Another issue is how the cost of measuring devices can be covered.

This is especially so among emerging farming communities. "Emerging farmers face so many challenges, not the least of which is a lack of financial and human capacity and access to markets, among others. These issues have to be addressed first before water measurement can be considered a priority, although a start should be made to create awareness of water availability, use and cost recovery," says Van der Stoep.

Accurate measuring devices are expensive and all measuring devices are dependent on correct installation, regular maintenance and calibration, while capturing and recording readings are either labour or instrumentation intensive.

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But rather than be a hindrance, water measurement can be a helpful tool. The fair distribution of water on small-scale irrigation schemes in the former homelands areas, for example, is probably one of the biggest causes of conflict among the participants. Often conventional water management procedures are inappropriate, or water management infrastructure is vandalised. This makes it almost impossible for anyone on the scheme to irrigate successfully. Implementing appropriate water measurement tools supported by training and capacity building can assist matters greatly.

CHOOSING THE RIGHT TECHNOLOGY

There is no one magic solution or technology out there to measure irrigation water. Each WUA's situation is unique, and no two WUAs can blindly use or apply the same devices or methods

The selection of a measuring device will depend on how the characteristics of the available devices satisfy the requirements set by the WUA. To

Several water measurement methods are reviewed in the new WRC report.

help WUAs choose the technology that is right for them, the project team compiled a water measuring guideline and developed a computer-based database of commercially available measuring devices for irrigation water.

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The guideline comprises a series of components. They include:

- A reason for measuring;
- Acceptance and support by the water users;
- Assessment of the current situation and planning the system;
- Choosing appropriate technologies;
- Correct installation by skilled technicians;
- Sound operation and maintenance policies;
- A system for data retrieval and management;
- Comprehensive financial planning; and
- Procedures for handling disputes and tampering.

"Water measurement in some form is now a management imperative and, therefore, these guidelines are absolutely essential to meet the requirements of modern farming," Dr Backeberg points out.

THE WAY FORWARD

The legal requirements of the National Water Act are clear. In order to successfully manage and license water use it is necessary to quantitatively verify water use. While there is definite interest from farmers to implement water measurement, across the board overnight introduction of measuring water volumes is neither economically or physically possible, comments Van der Stoep.

"We have had lots of interaction with farmers during the course of this project, however, there is still much knowledge dissemination that needs to take place. There are plans to launch a series of regional workshops before the end of the year. Based on the completed project and guidelines an easy-to-use training manual will also be compiled."

It has also been recommended that a knowledge centre be created to continue research, prepare and distribute information, train students and provide a field service to WUAs in assisting them with measuring, implementation, evaluating devices and trouble-shooting.

At the same time, the WRC, together with the ARC has initiated a major project and is collaborating with farmers on irrigation schemes in selected WUAs on standards and guidelines for improved efficiency of irrigation water use. In another WRC initiated project, a consortium of researchers are cooperating in a technology transfer project to promote the integrated implementation of irrigation management models.

To obtain a copy of the report, Guidelines for Irrigation Water Measurement in Practice *(**Report No TT 248/05**) contact the publications department at the WRC at Tel: (012) 330-0340, Fax: (012) 331-2565 or E-mail: publications@wrc.org.za*