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ICID NEWS

MANAGING WATER FOR SUSTAINABLE AGRICULTURE

MESSAGE FROM
THE PRESIDENT

Dear Colleagues,

22nd March 2016, the World Water Day, with the theme "Better water, better jobs" provides us with the opportunity to delve upon the impacts of water management, good or bad, on the livelihoods and jobs. Irrigation and drainage provide impetus to the jobs in agriculture sector. Not only in agriculture, water is a provider of a variety of jobs: the unpaid job of the girl child forced to fetch water form long distances; the ill-paid job of a sewage system cleaner through manual labour or a farmer engaged in tendering his crops. The wellbeing - social, economic and mental - of the workers in all the cases depends on the way we manage our water. We can make these jobs better through better water management. I am sure that the international water virtuosos not limit their efforts in this direction to a specific day in a year, but promote public awareness on the importance of fresh water availability on creation of new jobs and the role of better water management in making these jobs better throughout the year. Commemorating achievements on this very important day provides the desired stimulus.

During recent years, accessibility to reliable water resources has increasingly acquired the pivotal role in most local and regional development plans worldwide. This is well acknowledged by the global leaders through the recent adoption of the "Sustainable Development Goals (SDGs)", as part of the Development Agenda 2030. Water and food security, and poverty eradication hold the foremost position in these SDGs. The issue of water, food and energy nexus has to be main streamed in these goals. I believe that without concentrating on agricultural water management, and the rural development, fulfilling such goals are unattainable.

In the past decades, developing irrigated areas in the world, particularly in developing countries, was overshadowed and affected by transferring management of the irrigation systems to users associations without achieving the required prosperity and success. ICID should implement its utmost measures to pave the way to provide appropriate guidelines upon the present and past, success and failure experiences worldwide. Such guidelines could be used for the present and future irrigation management transfer schemes.

The 2nd Asian Irrigation Forum, organized by Asian Development Bank (ADB), held from 20-22 January at Manila, Philippine, highlighted various areas of irrigation such as revitalization of irrigation in Asia, a continent holding 70 percent of the world irrigated agriculture. ICID NEWS presents an article that provides briefly the outcomes of this forum with a view to inform the outcomes to the National Committees (see page 6). I encourage NCs to disseminate this among the interested public and private irrigation communities and adapt these outcomes suitably to meet their respective national goals. These would be further followed up at the 2nd World Irrigation Forum (WIF2) at Chiang Mai, Thailand from 6-8 November 2016.

The International Steering Committee (ISC) of the 2nd World Irrigation Forum (WIF2) held its second meeting in Thailand and was satisfied with the praiseworthy attempts of Thailand National Committee on Irrigation and Drainage (THAICID) in making all out efforts in its preparation. The hosts have planned for an excellent venue that provides an excellent background for an International Exhibition. I invite all ICID members, consultants, manufacturers, contractors, farmers and young professionals and those involved in the water industry to actively participate in this important event and the international exhibition.

In order to privide a platform to all the Young Professionals interested in agriculture water management issues and help for a meaningful and coordinated discussions, ICID has recently launched a dedicated LinkedIn Group for young professionals "ICID Young Professional e-Forum (IYPeF)". The group will serve as a platform for all information related to young professionals, training opportunities, selected openings, availability of scholarships etc.

More than 20 African Young Professionals are sponsored by ICID and its partners. They will be starting a training course from 19-24 April in Cairo, Egypt and will also be attending the 4th African Regional Conference (ARC) that follows from 26-28 April 2016 in Aswan, Egypt. I take the opportunity to invite all the national committees of the ICID, particularly the African members to attend this important regional conference by availing the opportunity of exchanging knowledge and knowhow on the specific issues of irrigation and drainage in Africa. I am hopeful that this regional conference will add value to regional scientific development.

I look forward to meeting you all at this forthcoming fabulous event on the banks of Nile.

Dr. Saeed Nairizi
President, ICID

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Inside

Technology Smart Approach to Keep Drip Irrigation Systems Functional

Felix Reinders*

The world's population is projected to reach 8.5 billion by 2030, 9.7 billion by 2050 and as water stress spreads around the globe, finding ways of getting more crop per drop to meet our food needs is among the most urgent of challenges. The first answer to this call is drip irrigation, which delivers water directly to the roots of plants in just the right amounts. It can double or triple water productivity – boosting crop per drop – and it appears to be taking off worldwide. Over the last twenty years, the area under drip and other "micro" irrigation methods has risen at least 6.4-fold, from 1.6 million hectares to more than 10.3 million. The author, Er. Felix Reinders, is the Chairman of ICID Working Group on Sustainable On-Farm Irrigation System Development (WG-SON-FARM) established to promote on-farm irrigation. The group has brought out many publications for planning, design and evaluation of micro and sprinkler irrigation systems.

Capital investment in drip irrigation is very high and it is imperative that the system should provide with years of high performance to get sustainable yields and therefore a good return on the investment. In many countries, governments subsidise or provide drip systems free of charge to farmers to improve their quality of life and to achieve food security. The biggest problem with drip is clogging and if not managed well it will dramatically shorten the continuous usage of the system.

Innovative technology that uses ultrasonic sound to clean drip pipes was developed to embrace the efficiencies offered by drip irrigation in order to preserve precious water resources and to get a return on the investment. The technology known as Greendrum technology uses only sound for cleaning and maintaining drip irrigation pipes. It uses ultrasonic sound in a small body of water to effectively and quickly clean drip irrigation lines and pipes with ease. It is environmentally friendly and does not use any chemicals. There are a mobile unit (Photo 1) and a stationary unit with three model sizes (Photo 2). All work on the same principle.

Drip irrigation is considered as the most efficient irrigation system, but there is sufficient proof obtained from field testing that this system can also be in-efficient, due to clogging of emitters as a result of bad water quality, mismanagement and maintenance problems. There are four ways drippers can clog and it includes the following:

- Silt (mud from dirty water)
- Bacteria and fungi (organic material)
- Chemicals (from using fertiliser)
- Metals (Iron and manganese)

Various approaches in preventing the clogging of emitters includes: filtration, flushing and chemical treatment of the irrigation water but they address mainly organic material. Ultrasonic sound on the other hand addresses all the clogging substances.

Photo 1: Mobile unit

Photo 2: Stationary unit

Through intensive laboratory and field testing by the Agricultural Research Counsel's- Institute for Agricultural Engineering (ARC-IAE), results were obtained and analysed that gave some insight into the performance of drip irrigation systems under field conditions. Studies has also been conducted on the usage of ultrasonic sound to clean the drippers.

There was a clear indication that drippers were clogging regardless of maintenance and treatment with chemicals. There was a tendency that the Emission Uniformity (EU) as measured in the field of all the dripper types deteriorated over time from a new pipe EU of 92% to 87.1% in the first evaluation to 82.4% in the fourth and last evaluation one year later. With regard to the statistical discharge coefficient (Us), the drippers met in only 69% on average, the requirements.

With the Greendrum dripline cleaning machine, the results showed that there was a 73% change in the Coefficient of variation (CV) of the dripper line from a bad CV of 10.57% to an excellent CV of 2.85%. As the drippers could not be cleaned in any other way, the Greendrum ultra-sonic sound way was extremely effective and totally recovered the clogged drippers.

What the ultrasonic sound does is create millions of tiny vacuum bubbles on every micro surface of the dripline that will then implode in the pipe and cause shockwaves that completely strip all impurities in seconds. It can clean 900 meter of dripper line per hour at a cost of US$0.01 per meter.

The uniqueness of the machine cannot be overemphasized. It is environmentally friendly and does not use any chemicals. With the three models available, various farm sizes can be serviced and it can create many jobs to manufacture and also to deliver a service to the farmers with drip irrigation.

There are a number of machines that operates successfully in South Africa and the innovator and patent holder of the technology would like to share and sell this technology to the industry to implement it world wide in the interrest of drip advancement in the world.

The innovater, Mr. Leon Lingnau can be contacted on: Tel: +27 (0) 82 896 0393, E-mail: leon.greendrum@gmail.com, Website: www.greendrum.co.za

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Water, Energy and Food Supply Chains for a Green Economy

Willem F. Vlotman[1] and Clarke Ballard[2]

This article provides a wider perspective on more efficient water use through the water, energy and food nexus approach. The nexus refers to the linkages and dependencies between the three elements and aims at the most efficient; best practice principles applied throughout the full food supply chain in the use of water; energy and food. The Green Economy refers to an economy that espouses the sustainability principle by giving due attention to environmental concerns while eradicating poverty and hunger. This is an abridged version of the article published in the Irrigation and Drainage Journal, Special Issue: First World Irrigation Forum, April 2014, Volume 63, Issue 2.

Food security is an important political priority of high complexity. The supply and consumption of food is strongly impacted by population growth, the effects of climate change, new technologies, sharp increase in energy demands and shifts in consumption patterns. Water and energy are two of the most critical factors essential for producing food.

In order for us to improve efficiencies of water, energy and food usage, it is helpful to have a closer look at the water-energy-food supply chains that interact from the farm to the consumer; from field to fork. There are many possible variations of supply chains and each is an actual, potential or scientific chain of events. In fact these chains will vary amongst countries depending on the institutional or business model that is prevalent. This article describes three possible water, energy and food chains and points to potential efficiency gains in each sector. Efficiency gains in the energy and food chains will save virtual water; i.e. water used in producing the energy and food.

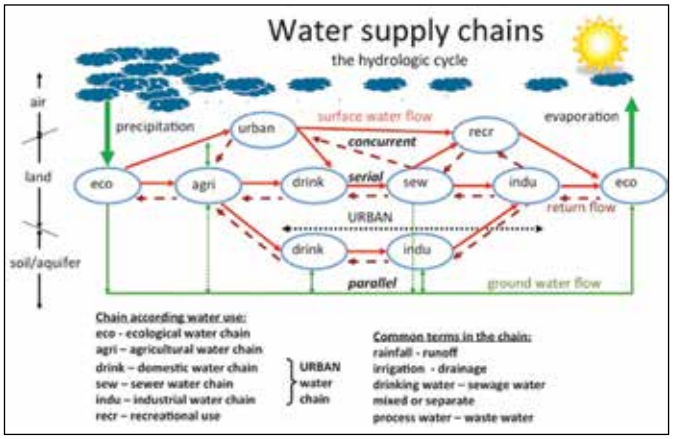
Water supply chain

The water supply chain is embedded in the hydrological cycle commonly used by water scientists to explain the relationships in the water chain.

Depending on the use of the water, a water supply chain will typically comprise a source distribution network, its actual water use at location, the removal of excess/waste water, and possibly recharge to a downstream source. Therefore, there are many sub-chains within the hydrological cycle. Each sub-chain will have its own key performance efficiency indicators according to the specific details of the water use sector whether it will be environmental, agricultural, industrial, municipal, disposal, or recreational.

Energy supply chain

The energy supply chain includes solar, wind, hydro and fossil fuel used for generation of electricity, heat and energy. These are then used in processes to produce and transport food and thus link to irrigation and drainage; i.e. water. It therefore makes sense to have a closer look at the energy chain. Starting from various energy sources, including solar and hydropower, energy flows through distribution networks to a variety of users including agriculture (farm use) and agro-industries. There is a need to have a closer look at the energy used at each point in the energy chain to produce, manufacture and distribute food products.



Water supply chains; i.e. the hydrological water cycle

In Australia, it was identified that the largest energy use associated with water is in heating of water in domestic, commercial and industrial applications. Water heating accounts for about 25% of all residential energy use, but it could be halved through water-efficient appliances and more efficient water heaters. Even greater energy benefits may be gained in industry, where reductions in steam and hot water losses, reduced pumping in manufacturing and cooling, can result in potentially significant energy savings and thus result in less water use.

Since the mid-1980s, substantial energy savings have been implemented at field scale when high-pressure, high-energy centre-pivot and linear-move irrigation systems switched from overhead sprinkling to drop-tube application of water. Energy and water savings in this manner have been substantial in North America but less so in Australia, where most systems are low-energy surface irrigation systems. Still, application of low-energy precision application (LEPA) systems in Australia can result in substantial water savings compared to furrow and border flood irrigation systems. The higher energy use of LEPA systems compared to surface irrigation may be offset in financial terms by the savings in water. In fact less water means less energy spent in distributing the water. There are many other possible examples of reduction in energy use, however, the intent here is to merely point to some options and to encourage readers to investigate further and be innovative.

Food use efficiency

Food waste is a concern as it implies loss of virtual energy and virtual water. Therefore reduction of food waste is a source of potential water and energy savings. Food wastage accounts for 1380 km3 of (virtual) water being wasted globally every year and equivalent to a value of US$ 252 billion. This equates to per person waste of, an average 243 litre of water a day in the food thrown away or discarded. This amount of virtual water wasted (at the table and in supermarkets) is over one and a half times the average water use per person at home. Reducing this food wastage will not actually save millions of cubic metres of water that can be used for the environment or the green economy. In fact, both water and energy are already virtual (i.e. embedded in the end product), but reducing the wastage will go a long way to achieve the global estimated food requirements in 2050; more bite per drop.

Hence, reducing food wastage means more food can stay at the source, which then can be used to feed more people. By saving virtual water and virtual energy down in the supply chain, it can be distributed

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elsewhere. No need to produce more food in that case; by being more efficient more mouths can be fed per kilogram of production. More crop per drop and more bite per drop; the same amount of water used more effectively. In order to achieve this and take advantage of the nexus approach, the supply chains have to be managed through appropriate institutional mechanisms.

The way forward

A key to efficiency gains in water, energy and food is in the management of the supply chains and creating awareness of the current inefficiencies in the full supply chain; from field to fork. Management of a supply chain may be centralised or rely on several institutions and companies up and down the chain, each providing its own individual service to the chain. The objectives of chain management in the case of achieving efficiencies as described herein, should be focussed on reducing wastage at all levels in the water, energy and food chains. To achieve this, barriers will have to be broken down, institutional arrangements realigned and public awareness to be increased. A recommended approach is the bottom-up one: start with the end users, see what their perceptions are and create awareness of low efficiencies in water, energy and food use. Then design a process to improve efficiencies at various levels in the supply chain and prepare institutional arrangements with key stakeholders to make the chain work as a unit. All the work at ICID can be further enhanced, if current wastage of virtual water in the various supply chains is addressed and negated.

Full version can be downloaded from http://www.icid.org/best_pap_2015-ird-63.2.pdf

Water and Waste Water Nexus Approach Blue and Grey Water Nexus Approach

This article is an extract of the Keynote Speech delivered by President Dr. Saeed Nairizi* during the Dresden Nexus Conference 2015: Global Change, SDGs and the Nexus Approach, held from 25-27 March 2015, Dresden, Germany. The conference was attended by over 350 participants from 65 countries, which includes representatives from UN and international organizations, universities and research institutions, etc.

Urbanization is a population shift from rural to urban areas and the way in which society adapts to the change. The growing world population exacerbates the urbanization process to the extent that the urban population will increases from 50% of the global population at present to 70% by the year 2050. The driving force of such transformation is the unbalanced pattern in economic growth occurring mainly in developing countries, where rural communities are unable to generate sufficient income to support their livelihood, particularly to cope with the population expansion in these regions. World agricultural production accounts for less than 3% of the global GDP, where it is estimated that within the next 10 years the 2000 world megacities will contribute about 75% to global GDP. Since cities have the upper hand when it comes to capital investment, industrial activities and job opportunities, migration of rural inhabitants to cities is an inevitable phenomenon and expected to be intensified in the future. Consequently, it is reported that the absolute number of rural population worldwide has reached its maximum level and will begin to decline from now on, and urban population will sharply increase accordingly.

There are many concerns about the increase in water demand due to the expansion of urbanization and the environmental and health hazards associated with waste generated in the cities. However, in a general situation where irrigated land is converted to an urban area, the water demand demonstrates no significant changes. This is due to the fact that irrigation water requirements for a given area are almost equivalent to the municipal water consumption in the same area given an average population density. It is also important to note that an integrated approach to water supply and wastewater management within urban regions would provide opportunities to recover up to 80% of consumed water through wastewater reuse, whereas in an irrigated land the returned water may account for only 20% to 30% of applied water. Therefore, it could be stated that the national or even regional urban demand for water is not a strong opponent to the agriculture sector.

In a case study in the city of Mashhad in Iran, the treated wastewater has been programmed to replace partially the municipal water demand. Through this holistic approach, the urban water demand is categorized by the required quality, and treated wastewater should meet these requirements. Through this programme, 20% of the recovered water is allocated to the city parks and green area, 20% to the local industry and 60% (the remaining effluent) is considered for urban agriculture. The concept of urban agriculture development shows very promising socioeconomic advantages. The high reliability on the availability of treated urban wastewater and access to the market for agricultural products would provide opportunities for high-value cash crop production in the vicinities of cities. Hence, the revenue and job creation in this regard would compensate by far the probable crop production decrease due to the reallocation of water resources from agricultural to urban use.

However, attention should be focused on the water and wastewater Nexus Approach within the urban and pre-urban area – from water supply plan to wastewater management and reuse as well as from standardization to environmental and health monitoring issues. Adopting appropriate technology for decentralized wastewater treatment plants scattered within the urban region is a key to the success. Indicators and practical approaches for the safe use of treated wastewater should be carefully selected, setting reasonable standards upon the mode of consumption (e.g., if it is used for green parks or urban agriculture or indeed for ground water recharge). The attention to the socio-economic sphere is the most important consideration in this regard.

There are other issues associated with urban development that need more consideration. The rural population migration to the cities is mainly due to the socio-economic conditions governing their livelihood and ambitions to seek a better life, which they cannot fulfill in the rural communities. They try to make their dreams a reality by indulging themselves in the activities of a nearby town or city. However, if they are not welcome by unprepared nearby cities, they will not go to the next nearest city. Rather, they take a big step towards the biggest market they perceive – the large cities. This is the main reason for megacities' formation with all their associated problems.

To avoid such a dilemma, attention should be given to the development of small and medium sized cities to accommodate the rural migrants close to their homeland. Investments in employment opportunities, health and education services are examples of such considerations. This decentralized urban development strategy would divert the negative impacts of megacities' formation, particularly in developing countries, to an engine for national growth, poverty alleviation and human resources development.

Recommendations

It can be concluded that urbanization per se is not a threat, but urban population governance that needs attention. The following recommendations would augment this conclusion:

- urbanization is a national and local strategy for any socio-economic development plan;
- water-energy-waste nexus approach is the main pillar for a successful transformation of neighbouring rural communities into a developed urban region;
- wastewater collection networks and treatment plants should be designed as decentralised schemes to allow the treated wastewater to be used locally with minimum energy requirements for pumping up;
- standardisation and monitoring of the wastewater effluent quality is an essential practice, however, the considered standards should be reasonably achievable.

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Improving Water Productivity: Can Technologies Pave the Way

Ms. Yasmin Siddiqi*

Water resources are becoming increasingly scarce in the Asia Pacific region, mainly due to rapid population growth – which will bulge at 5.2 billion by 2050. About 80%, the major share of Asia's finite water resources is currently diverted for agriculture purposes. But as the region rapidly urbanizes, there will be demand for more water from hungry mouths, thirsty cities and more energy for homes and industries. Estimates for Asia predict a 65% increase in industrial water use, 30% increase in domestic use, and a 5% increase in agriculture use by 2030. By 2050, agriculture will need to produce 60% more food globally, and developing countries will have to double their food productions to feed their growing populations.

If we look from the climate change lens, then we enter a new era where increased variability in rainfall, temperature and water resources availability will place new pressures on already scarce water resources. Aging infrastructure, weak institutions and poor water management result in low productivity and inefficient use of water for food production. To provide water for all users, there is no option but to water use efficiency in agriculture by producing more crop per drop of water.

Second Asian Irrigation Forum

The Asian Development Bank's Second Asian Irrigation Forum (AIF2), held from

20-22 January 2016, Manila, Philippines, looked at these challenges and presented examples of how developing member countries, farmers, knowledge partners and the private sector are exploring opportunities to make better use of water in agriculture.

The event was attended by over 200 participants from a range of backgrounds including, civil society, government agencies, youth and knowledge partners. A poll conducted after the event on "how can Asia grow more food with less water" had 54% of participants recommending technology based solutions.

Events like the AIF2 provided a suitable regional platform to share and disseminate ideas, best practices and new approaches. The event was well received by the participants and drew together a mixed group of stakeholders to share experience and learn from each other. Individuals took away their own learnings, lessons and insights but also contributed to the formulation of the understandings and actions proposed above. The outcomes of the event will contribute to the dialogue of the Second World Irrigation Forum (WIF2) to be held at Chiang Mai, Thailand in November 2016.

Finding Solutions in an Evolving Situation

The Asia region is increasingly familiar with the challenges of competing demands for water and climate change impacts. Yet the confines of weak governance and institutions are major hurdles in moving forward to find sustainable solutions for "doing more with less". These require more innovative and cross-sector approaches, which recognize water as being intrinsically linked across all uses and users.

Decision makers are often ill-informed about what drives trends in resource utilization – especially at the local level and the merits and implications of adopting different technical options. One of the biggest gaps is the lack of knowledge about the nature and magnitude of the interdependencies, which is needed to inform decisions.

Solutions to tackle this more complex environment require a more interconnected approach in which there should be thinking across sectors. Increasingly, new approaches are being successfully deployed in order to tackle these challenges. Whilst technologies are emerging all around us – they remain localized and information on achievements is not always disseminated.

Water-Energy-Food Interlinks

More than one-third of the world's 303 million hectares irrigated area is served by groundwater. Of this over 70 percent is in Asia - with the Peoples Republic of China, India, Pakistan and Bangladesh being the region's largest consumers. Yet continued expansion in groundwater use has impacts on declining water tables, demand for energy and the cost to the power and water sectors do not get translated in to sustainable solutions – including more robust policy and regulatory environments.

Solar irrigation pumps provide an opportunity to use clean energy sources – and can encourage energy and water efficiency, if there is a suitable incentive mechanism, so that farmers better manage the volume of water pumped.

ADB is assisting the Government of Bangladesh by supporting the Infrastructure Development Company Limited (IDCOL) to install solar irrigation pumps (SIPs). IDCOL has set a target of installing 1,500 SIPs by the year 2016. Whilst there is interest from rural communities, the main challenges to more rapid uptake are: (i) high cost of the technology; (ii) lack of awareness amongst customers about the technology and its benefits; and (iii) highly subsidized diesel and gasoline which makes conventional technology, though polluting, cheaper than SIP.

The state government of Karnataka, Govt. of India has gone a step further. Its solution to solar irrigation goes beyond just the technology, and considers the broader policy environment. The state offers a guaranteed buy-back of surplus solar power from SIP owners at an attractive feed-in-tariff. This combined with metering incentivizes farmers to raise energy and groundwater productivity by investing in micro-irrigation.

In this case whilst the technology exists and is relatively straightforward, it is more the financing mechanism and associated incentives to farmers which will make this a more readily adopted option.

Measuring Water Productivity

The challenge to grow more food with less water requires an increase in water productivity. Several international organizations (like FAO) have agreed that crop water productivity should be defined as crop yield (kilogram per hectare) per unit of water consumed (cubic meters per hectare). This directly support sustainable development goals (SDGs) 6.4 which requires a substantial increase in water-use efficiency across all sectors to address water scarcity.

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To date interventions have focused mainly on infrastructure solutions which has detracted from fundamentals like improved land and water management practices at the field level to increase water use efficiency and productivity.

The reality is more challenging, given that there is very little flow measurement on irrigation systems, especially at field level. Farmers do not know how much they receive in terms of volume of water and attributing agricultural production against a volume of water is difficult. It is most usual that agricultural productivity is set as the target as yield is easily measured. So far there is little or no quantification of crop water productivity, its regional variations and benefits derived through development interventions.

Organizations like UNESCO-IHE have developed suitable software to compute daily and weekly dry matter production of crops, in association with crop transpiration, crop interception and soil evaporation. Using high resolution satellite imagery and ground truthing provides much opportunity to ascertain crop water productivity and undertake comparative analysis of why certain areas may perform better than others?

Despite availability of such tools, field implementation has been limited. ADB is now leading the way to provide a more comprehensive assessment of water productivity in the Asia region. Measurements will commence in 2016 in 6 countries spanning the region. These will form the basis for more systematic measurements and a tangible basis against which the future benefits of irrigation investments can be assessed.

Simplicity of Technology

Levelling is a fundamental practice for land preparation and improved management. Whilst it remains a conventional practice in many countries, major strides were taken in early 2000 to introduce laser land levelling. This uses laser guided equipment to more accurately level fields.


Photo: Prashanth Vishwanathan (IWMI)

Trials in South Asia demonstrated higher crop yield could be achieved on laser land levelled fields, with reduced energy and labor inputs. The International Water Management Institute (IWMI) through a 3 year (2004-2006) pilot demonstration of laser levelling for cotton, showed average annual net income from the laser levelled field increased by 22% and gross margins were on average 92% higher than a control field. More recent IWMI research in Punjab, Pakistan for cotton (2014 summer season) achieved a 12% increase in water productivity (kilograms per cubic meter) and an 11% increase in land productivity.

Contrastingly in central Asia region - which despite having more than 5 million ha of irrigated land, extensive problems of salinized soils, limited water availability and low water productivity – the adoption of laser land leveling has been extremely slow. In Uzbekistan the techniques has been demonstrated in the form of pilot projects for more than 20 years with similar results yet adoption remains effectively zero despite costs of laser land levelling having fallen substantially in recent years.

Despite a relatively simple, well tested and proven and readily available technology, its uptake remains sporadic and region specific. What has been adopted so readily in South Asia, is practically a non–starter in Central Asia. Technology uptake has increased in the South Asia region. This is partly driven by water scarcity, high pumping costs and government policy to encourage adoption of water saving technologies. Understanding beyond technology and identifying constraints is the next step for the region. There is a vast potential to improve productivity, if more tailored strategies are provided – which also incorporate institutional aspects and design incentives.

Summary

The adoption of improved technologies in irrigation and attempts to tackle the water-energy-food interlinks remain sporadic. To date they are largely de-linked from an overall strategic vision for high efficiency options with improved water and energy accounting.

Examples of even simplistic technologies, like laser land levelling highlight that a success in one region may not necessarily have the same traction in another. In this case, there is a need to look beyond the technology itself and ascertain the institutional and policy frameworks, which limit uptake.

This new era where water resources are increasingly scarce and demands are ever increasing. To improve productivity, it requires sound messaging on how technologies can contribute and an understanding of the intricacies of sound financing models and incentives. The latter requires us to consider expertize beyond that of water resources and consider, finance sector expertize.

Ultimately, it is these aspects that dictate success or failure – rather than technology itself.

"ICID is continuing to invest in youth and empower them through knowledge."

— President Dr. Nairizi

Limpopo Smallholder irrigation Management Issues

Lani van Vuuren*

While it is recognised that smallholder irrigation schemes can make a contribution towards alleviating household food insecurity and poverty levels in South Africa, examples of vibrant and successful schemes remain relatively few. In addition to the challenges of management and infrastructure maintenance, smallholder irrigation plot holders are now also facing a new threat in the form of land grabs.

Out of the 300 or so smallholder irrigation schemes in South Africa, around 200 000 farmers and their families make a living. The issue of illegal occupation and urban encroachment is one of the challenges standing in the way of smallholder irrigation scheme, uncovered during a recently published research study undertaken by the Department of Crop and Animal Sciences of the Tshwane University of Technology (TUT) and the Agricultural Engineering Institute of the Agricultural Research Council.

According to the report funded by WRC, "Improving plot holder livelihood and scheme productivity on smallholder canal irrigation schemes in the Vhembe District of Limpopo Province", the root cause of the problem appears to be the trust tenure system, which prevails at most of the irrigation schemes in Vhembe. Trust tenure is regarded as the least secure of all systems applied to African land holding, the report points out.

Overcoming Insecure Tenure

In a trust tenure system, land belongs to the state and land use rights are awarded and regulated by the state government only. Prior to 1994 these regulations were strictly enforced and managed all aspects of plot holders' lives, from the time they were allowed to be absent from the scheme, to what they planted and when, and that they had to provide labour to maintain the irrigation works infrastructure. Disobeying any part of the regulations meant immediate eviction from the plot.

Following South Africa's democratisation the trust tenure system prevailed at schemes at Dzindi, however enforcement of the terms and conditions for occupation were notably relaxed. While this has removed many of the anxieties plot holders had in the past about losing the user rights over their irrigation plots, it has inadvertently also contributed to the deterioration of conditions on the scheme.

In addition, plot holders have seemingly lost their exclusive rights to use the land surrounding the irrigation scheme. At Dzindi, commonage land has been converted for residential purposes, bringing residential developments onto the commonage of the scheme. Township areas are now extending into canal areas, and basic housing has been constructed on commonage land. This is rapidly reducing the size of the land resource.

According to Prof. Wim van Averbeke of TUT, the issue of urban encroachment on irrigation land is bound to affect schemes that become part of peri-urban areas as a result of urban expansion. "In these circumstances, the value of land increases greatly, because people are looking for residential land. On the other hand, such locations are extremely favourable for farmers, because of the closeness of substantial markets for their produce". The degree of commercialisation on smallholder irrigation schemes in Vhembe was found to be associated directly with the location of schemes in relation to local urban centres. As distance between scheme and urban centre increased, farmers were less likely to produce for marketing purposes. "Smallholder schemes of about 50 plots of 1 to 2 ha located close to towns or cities generally have the best potential to generate livelihoods linked to food value chains, particularly those involving perishables and semi-perishables".

Improving Management

Lack of effective management of smallholder irrigation schemes in Vhembe has not only led to illegal occupation of farm land. It has also had a marked effect on the productivity of schemes. "Scheme management, of which water distribution and routine maintenance of the system are central, depend on a rule system and collective action in adhering to that system", explains Prof. van Averbeke. Few of the schemes investigated by the research team had such a management system in place. On the schemes that did have a management system it was generally not enforced.

On schemes where little to no management takes place, infrastructure is allowed to deteriorate rapidly. In addition there is a lack of proper scheduling of irrigation, leading to upstream farmers extracting more than their share of water, leaving too little for those farmers situated downstream of the irrigation canal.

At Dzindi the project team discovered large holes, cracks, misalignment and missing sections along the main canal, causing leakage. Aqueducts and sections of the canal that passed under bridges were of particular concern. Canal water was also lost due to the absence of or poor working order of the gates regulating the flow of water. Plots located at the tail end of the canal received too little water to enable effective short furrow irrigation.

It was further found that of the 48 smallholder irrigation schemes investigated, only 27 had a water license issued by the Department of Water Affairs. Payment for water occurred at only 17 schemes, but water was paid for by the Limpopo Department of Agriculture, not the farmers themselves.

According to Dr. Gerhard Backeberg, Executive Manager of Water Utilisation in Agriculture at the WRC, while the findings of the study were not necessarily surprising, the consequences of the underlying causes for underperformance are a major concern. "Management deficiencies and problems with tenure are interrelated and require decisive interventions. Tenure reform is essential to ensure tenure security at smallholder irrigation schemes, while priority attention should be given to improving the knowledge and skills of smallholder farmers. This will provide incentives for individual farmers and groups of farmers to better manage the plots and schemes to the best of their capabilities".

Way Forward

The report has highlighted important issues in the revitalisation of smallholder irrigation schemes, notes Dr. Backeberg. He continues to say that this investment in human and social capital must receive priority attention, in contrast to the usual preference to invest in physical and natural capital, i.e. infrastructure on irrigation schemes. "This report directs attention to key issues of management and land tenure, which should be addressed as a matter of urgency. A long-term approach with a focus on investment in people is necessary rather than attending to short-term, quick-fix solutions. Of course, on some irrigation schemes, refurbishment and upgrading of infrastructure is necessary, but this should not receive exclusive attention".

It is only through these long-term investments in people that we will see smallholder irrigation schemes reach their full potential and become the food baskets.

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