2018 I THIRD QUARTER

ICID NEWS

MANAGING WATER FOR SUSTAINABLE AGRICULTURE

MESSAGE FROM
THE PRESIDENT

Dear Colleagues,

The International Conference and the 69th International Executive Council Meeting of ICID held from 12-17 August 2018 in Saskatoon, Canada witnessed more than 500 global experts and discussed ways to overcome the most pressing problems of the water sector. For me, it was an immense pleasure to meet and interact with many of you at Saskatoon during the six-day event. I hope you all had a wonderful stay and visited excellent irrigation facilities shown as part of technical tours.

Moving forward, I am pleased to inform you that the Indian National Committee of ICID (INCSW) will be organizing the 9th International Micro-Irrigation Conference (9IMIC) from 16-18 January 2019 in Aurangabad, India. The conference aims to provide a platform to promote micro-irrigation as one of the improved water-efficient irrigation technologies and invite renowned researchers, entrepreneurs, policymakers and other stakeholders in the water sector to share their views and experiences of new technologies and best management practices in drip, micro-sprinkler and other localized irrigation systems. The irrigation efficiency can be improved dramatically using the micro-irrigation technologies and therefore, it would be quite interesting to observe and inculcate the latest trends and developments in this domain. Recognizing the advantages of micro-irrigation, several governments are now investing large capital through subsidies in promoting this practice, which is also beneficial to the environment.

Aurangabad city, a historical place surrounded with ancient caves and majestic temples, is very close to Jain Irrigation's sprawling campus which houses their R&D labs as well as a large commercial-scale facility for farmers' training and field demonstration centre. Our Direct Member Jain Irrigation, a global leader in efficient irrigation markets, has been working on micro-irrigation for several decades and I believe, Aurangabad is the right place for the micro-irrigation conference and participants would greatly benefit from the study tour to Jain Irrigation Centre which is a part of the conference. I would like to take this opportunity to request you all to kindly share the announcement in your professional networks so that we are able to attract abstracts from professionals engaged in high-quality research and development work on micro-irrigation.

The main theme of the conference is 'Micro Irrigation in Modern Agriculture' with Sub-theme 1: Micro Irrigation Design, Innovations, and New Techniques for increased Crop Productivity; Sub-theme 2: Micro Irrigation fund and Government support through Micro Irrigation; Sub-theme 3: Micro Irrigation for Cluster Level Farming & small farm holders; and Sub-theme 4: Operation & Maintenance Services and Capacity Development for the Micro Irrigation Systems.

Through this message, I would like to personally invite you all to be a part of India's, first of its kind, major international event on micro-irrigation. I look forward to meeting you all at Aurangabad. More information about the conference is just a click away: http://micro-irrigation2019.com

It gives me a great pleasure to further inform you that I was invited as a keynote speaker in the Global Water Security Conference in the great city of Hyderabad in India organized by the American Society of Agricultural and Biological Engineers (ASABE) and the Indian Society of Agricultural Engineers (ISAE). In my keynote speech I emphasised about ICID and its actions in improving the agricultural water management keeping in view the issues of water scarcity. I shared points on the major challenges faced by the water-energy-food nexus and how collaboratively we can move forward towards a water secure world free of poverty and hunger. In the conference, Secretary General Ashwin co-chaired a session on wastewater use for irrigation and the ICID Knowledge Team made two interesting presentations.

Finally, on behalf of ICID fraternity, I congratulate our Secretary General Er. Ashwin Pandya who has been honoured with the Lifetime Achievement Award for Dam Safety by Aqua Foundation, India.

Best regards,

Felix Reinders
President, ICID

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INSIDE

Negotiations for Resolution of Transboundary Water Conflicts

Hon. Karlene Maywald*

Webinars are taking the digital world by storm. ICID under its policy to extend its knowledge dissemination wider, conducts regular webinar services for its members in particular and wider agricultural water management community. Keeping in view of the importance of the trans-boundary water conflicts in the emerging world, ICID invited Hon. Karlene Maywald (Australia) an expert in water policies to share her experiences. A Webinar on 'Negotiations for Resolution of Trans-boundary Water Conflicts' was organized on 1 August 2018, which was very well received by the participants". Hon. Karlene Maywald is the Former South Australian Minister for Water Security and River Murray, and Former Chair, Australian National Water Commission. At present she is the Chair, International Centre of Excellence for Water Resources Management (ICEWaRM), and Strategic Advisor International Water Opportunities, South Australian Government. A live recording of the webinar is available on the ICID website, which can be reached from: http://www.icid.org/icid_webinar_11.html.

Negotiations for resolution of transboundary water conflicts are inherently challenging. Multiple stakeholders across a broad range of sectors and the highly political nature of water make it extremely difficult to develop and implement the long-term planning necessary to deliver sustainable water reform. This article explores the technical and political challenges facing Governments as they strive to achieve a secure water future for their communities and uses the Australian "Murray Darling Basin" as a case study.

Australia has faced many serious water challenges over many decades and has needed to change the way it thinks about water in order to build resilience and strive for water security. The Australian Constitution rests the responsibility for managing water to State Governments. Consequently, local interests superseded national interests, conflict arose between upstream and downstream communities, inconsistent policies and laws abounded, all leading to stressed and polluted environments and unsustainable over-use of the available resources.

The Murray Darling Basin system has one of the most variable river flow patterns in the world. Droughts and floods are frequent and climate change has exacerbated the extreme nature and frequency of events. Historically management focused on the development of the water resources for navigation and irrigation with the building of dams and weirs to regulate the system with little consideration of the long-term effects on the environment or sustainability of the resource.

Governance was managed by the Murray Darling Basin Commission – MDBC (formerly the River Murray Commission – RMC). Commissioners were senior water/agricultural bureaucrats from the States with an Independent Chair and decisions were made on the basis of consensus. In the 1980's, a Ministerial Council consisting of state water ministers and chaired by the Australian Government was established to have political oversight of the MDBC.

Whilst the RMC/MDBC functioned reasonably well, irrigation development expanded rapidly post 1950 and by the 1980's the stresses on the system were becoming very evident. It was widely recognised that national government intervention was required.

Where matters of national interest need

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to be considered, Australia has established a Council of Australian Governments (CoAG) as the forum for negotiating an agreement between the States and the National Government. CoAG consists of the Premiers and Chief Ministers of all States and Territories and is Chaired by the Prime Minister of Australia.

To advance water reform in Australia, two significant agreements were achieved by CoAG:

1. 1994 – National Water Reform Agenda

This agreement focused on the microeconomic reforms necessary to make water use more efficient and to increase productivity through the removal of barriers to trade water. [https://www.pc.gov.au/__data/assets/pdf_file/0007/228175/water-reform.pdf]

2. 2004 – The National Water Initiative (NWI)

This agreement focused on returning over-allocation of water to sustainable levels of use and an investment fund for research to bridge the knowledge gaps to enable better evidence-based decisions. The National Water Commission (reporting to CoAG) was established to oversee the states' compliance with the NWI and manage the research fund. [https://www.pc.gov.au/inquiries/completed/water-reform/national-water-initiative-agreement-2004.pdf]

Between 2000 and 2010 the Murray Darling Basin was hit by the most extreme drought in recorded history. The conditions faced were way outside any of the worst-case modelling based on 117 years of reasonably good data. The Millennium Drought had a huge impact on irrigation communities and the city of Adelaide almost ran out of potable water.

The Australian Government realised that it was time for serious National intervention and in 2007, they proposed a National Plan for Water Security and put US$10 billion on the table (increased to AUD $13 billion in 2008). The States were in such diabolical trouble, they had no choice but to come to the table. After protracted and intense negotiations, the States ceded some of their powers over water management to the Australian Government and new national legislation was enacted. The main objective was to reset the sustainable diversion limits (SDL's) for water extraction across the Basin – a task that had not been achieved anywhere in the world at this scale.

The new legislation was highly controversial and did not receive wholesome community support. The extremely diverse multicultural nature of the Australian population presented many challenges in the negotiations as did the underlying expectation that water is a human right that should be readily and freely available.

It took a further 5 years for the Australian Government to successfully negotiate 'The Basin Plan' to reset the balance between environment and extractive uses of the water resources of the Murray Darling Basin by 2019. The Plan is still controversial, and there are questions as to whether it can be implemented on time, however it is worth noting that The Plan has survived many changes of Government at both the State and National level, despite on-going challenges.

The Australian water reform journey is on-going and will not end with the full implementation of the Basin Plan. The uncertainty that climate change presents means that Governments will need to continue to seek new and innovative ways to meet the demands of growing populations that will continue to put pressure on potentially diminishing water resources.

So, what were the key elements that enabled Australia to implement the Basin Plan.

1. Recognition that water is a matter of national significance requiring a governance framework that brings all interested Governments to the table
2. Recognition that solving complex water problems is as much about behavioural change as it is about technical solutions and that political trade-offs are necessary
3. Recognise that science provides the basis on which political trade-offs can be negotiated
4. Recognise that appropriate levels of funding must be made available for research to improve knowledge and enable evidence to underpin decision making and inform decision makers of the consequences of political trade-offs
5. Develop capacity within Government agencies to engage with the research and industry sectors to improve innovation adoption
6. Effectively engage with and educate communities on the need for reform and why doing nothing is not an option. This includes gaining a thorough understanding of future risks if the change is not adopted
7. Understand that water reform is as much about regional/rural reform as it is about environmental restoration, so it is necessary to invest heavily in transitioning affected sectors (such as irrigation communities) to embrace change. This includes on and off-farm investments. There is no point in investment in more efficient delivery systems to the farm, if farmers still use water inefficiently on-farm
8. Coupling policy reform with new water infrastructure investment is more likely to deliver long-term, sustainable solutions
9. Basin-wide planning is essential to mitigate third party impacts from ad hoc policy reform or infrastructure investment
10. Be patient - gaining commitment for a long-term vision and goals that can transcend political-cycles is essential and the reforms will take time.

In summary, while politicians must accept the need for change, it is just as important for communities to understand the benefits of change and the risks of not changing. Governments that consider policy reform to support infrastructure investment are more likely to deliver long-term, sustainable solutions and Basin Planning based on robust science, forms the pathway that creates water security.

Water security is the key economic enabler of prosperity. It creates the confidence necessary for long-term investment by governments, irrigators and the private sector for a more prosperous future.

For more information, please visit the following links:

http://www.nwc.gov.au/publications/topic/assessments/australias-water-blueprint-national-reform-assessment-2014

https://www.pc.gov.au/inquiries/completed/water-reform#report

Innovative and Sustainable Water Management: Adapting to a Variable and Changing Climate

As part of the 69th International Executive Council Meeting held from 12-17 August 2018 in the city of Saskatoon in Canada, a dedicated international conference was successfully organized on the theme "Innovation and Sustainable Agri-water Management: Adapting to a Variable and Changing Climate" and three Sub-themes: (1) Competing Water Demands; (2) Resilient Agriculture – Adapting Agriculture to Climate Change; and (3) Irrigation and Drainage in Perspective.

In the Plenary session, two main concerns were highlighted. Firstly, the growing challenges of climate change leading to extreme flood and drought events and secondly, the food security threat for the growing population stemming from unsustainable water use globally. From the Canadian perspective, it was shared that to bring resiliency in the water and agriculture sector, a water security strategy and efficient water management in agriculture were the key requirements. Experts discussed the crop growth technology, productivity, socio-economic value of irrigation, water-food-energy nexus, climate change mitigation and water quality management for efficient agricultural production.

The concurrent sessions of the international conference focussed on drainage and flood control strategies, irrigation, drainage and flood control for resilient agriculture, irrigation infrastructure development and climate-smart agriculture and innovative technologies for enhancing water use efficiencies. With relevant examples presented from the Dutch water management systems, the successful approach of keeping lowlands dry for agricultural production was presented. Exceptional irrigation examples of Saskatchewan were also discussed. Combating the severe challenges posed by climate change, an emphasis on creating more robust water infrastructure was highlighted. In other sessions, the role of tools and technologies in increasing the irrigation efficiency was discussed. Modern techniques such as precision agriculture, use of soft computing used for decision support systems, use of remote sensing and geospatial data in combination with the field measurements were discussed at length during these sessions.

During the conference, FAO conducted sessions on 'Hydro-economic modelling for transboundary river basin management – Towards more Integrated Approaches' and 'Data-driven Improvement of water use efficiency in Small-scale Irrigation.' The former session deliberated on the challenges pertaining to the sectors competing with agriculture, especially hydropower, particularly in the transboundary regions. Additionally, solutions such as decision-support systems and multi-objective modelling systems to address these challenges were explored. The latter session provided case studies from West and East Africa on the techniques being used to improve the agricultural water management in the region. 'Irrigation Production Forum' and 'Financing Irrigation Forum' were also organized during the conference. The forum focusing on the irrigation production highlighted the challenges encountered due to evolving landscape and increasing global population needs and the opportunities arising with modernization and advancements in science and technology. The forum on the financing aspect of irrigation asserted that government support is necessary for developing the infrastructure and rehabilitation of the countries. It was further discussed that the cost-sharing between private industry/irrigators and governments varies considerably around the world and accordingly the private and the government sector should develop the investment plans.

Other parallel sessions included topics such as Irrigation and Water Resources Management in Transboundary Basins, Managing Competing Water Demands, Climate Change and its Impact on Agriculture, Irrigation and Drainage, Irrigation Water Footprint and Drainage and Flood Control Structures. The sessions on the climate change pointed out the major repercussions of global warming such as increasing global temperatures and increased frequency of extreme

events along with sporadic rainfall patterns suggesting that rainfed agriculture may become largely dependent on irrigation in future. The increasing global population is putting more pressure on the water resources, especially the share allotted to irrigation. The session on Drainage and Flood control structures presented case studies from Nordic countries highlighting the need for water management specific to the region with cold climates where snowmelt results in saturated soils. The transboundary management session emphasized the importance of irrigation for the economic growth of the nation. It was discussed that the investments in irrigation directly impact the shared economic benefits of the country and thus the technologies, methodologies and practices need to be aligned in a way to mitigate and adapt to the impacts of climate change.

Capacity Development

The Young Professionals training workshop focused on classroom sessions on the development, regulation and maintenance of Canadian irrigation systems. The sessions were further enhanced by a field visit arranged for the young professionals. The field visit included a hands-on session on soil sampling and modern techniques of irrigation scheduling and use of unmanned aerial vehicles to capture data through remote sensing. More information on training programs organized during the event.

Technical Tour

As a part of the Conference, several technical tours were organized for the participants. A Pre-Conference tour of South Saskatchewan River Irrigation District, held prior to the Conference included visits to various crop fields such as field peas, canola and lentils grown within this irrigation district in south-central Saskatchewan. Other highlights of the pre-conference tour included Canada's advancements in tools and technologies and irrigation research. During the tour, the participants also got an opportunity to visit the irrigation infrastructure of Canada using improved techniques such as membranes in the irrigation channels to reduce seepage, large-scale farm equipment and other important features of Canadian irrigation systems.

In the following days, other technical tours were organized to provide the participants with an overview of the functioning of irrigation, drainage, sustainable water management, agricultural research and practices in Canada. The tours included a visit to the South Saskatchewan River Irrigation District (SSRID) focusing on the water conveyance infrastructure and visit the farms in the Saskatoon area with a variety of crops and value-added products where drip irrigation is majorly used. Another tour was organized to visit the research facilities of the University of Saskatchewan's Innovation Place which is at the centre of plant and animal science research in Canada.

President Honorary Dr. Chandra A. Madramootoo conducted the opening ceremony and on behalf of the Government of Canada, Hon'ble Ralph Goodale, Minister of Public Safety and Emergency Preparedness welcomed the audience. Hon'ble Goodale remarked that water is critical to agriculture in the Prairies and to realize that potential in the face of frequent severe floods and droughts caused by climate change, better water management is essential.

Dr. John Pomeroy, Director of the Global Water Futures Program, University of Saskatchewan, kicked off the plenary session and provided an overview of some of the key challenges related to climate change including extreme floods and droughts.

President Felix Reinders pointed to the fact that as the water resources in the world remain the same, the population is growing and therefore we need to find solutions, methodologies and technologies to address the need for constant food supply.

Secretary General A.B Pandya drew the attention of the members to the Action Plan 2017-21 for the Road Map to ICID Vision 2030, International Research Program on Irrigation and Drainage (IRPID), role of Technical Support Program (TSP), Knowledge Management Strategy and other issues that required special consideration during the event.

Dr. Peter McCornick, Executive Director of the Daugherty Water for Food Global Institute at the University of Nebraska talked about challenges related to increasing food production for a growing world population and reflected on how effective water management is needed in order to ensure a more productive and resilient agricultural sector.

Mr. Maurice Molony, Executive Director and CEO of the Global Institute for Food Security discussed technologies for crop growth and productivity.

Mr. Warren Helgason, ICID Conference Co-Chair emphasized that as the globe experiences an increasingly variable climate, the need to share information regarding sustainable agricultural water management has never been greater.

Mr. Roger Hohm, President, CANCID gave an overview of irrigation and drainage in Canada stating that the region of Canada has adopted many leading-edge technologies to manage and distribute its limited water resources and further elaborated on the activities undertaken by the CANCID.

Dr. John Pomeroy, Director of the Global Water Futures Program of the University of Saskatchewan, kicked off the International Conference Plenary Session and provided an overview of some of the key challenges related to climate change including extremes floods and droughts. He suggested that a Canada water security strategy may be beneficial in being more prepared and achieve greater resiliency in addressing these challenges.

The Benefit of using Drainage Water of Fish Farms for Irrigation: Field and Modelling Study using the SALTMED Model

R.E. Abdelraouf[1] and R. Ragab[2]

ICID instituted the 'Best Paper Award' to recognise the outstanding paper contributed to 'Irrigation and Drainage', the Journal of ICID. The Wiley-Blackwell 2017 Best Paper Award was awarded to the authors for their paper published in the ICID Journal (Volume 65, Issue 2 in 2016). The award was presented during the 69th IEC meeting in August 2018 in Saskatoon, Saskatchewan, Canada. The full article can be accessed from http://www.icid.org/best_paper_2018b.pdf

In semi-arid regions, such as the Mediterranean, water resources are limited and the gap between water supply and demand is widening over time due to the continuous increase in water demand for food, feed and fibre for the ever-growing population. In such regions, water resources suffer from over-abstraction. Commonly, good quality water is scarce and thus water of marginal quality is considered for use in agriculture. The marginal water, also known as non-conventional water resources, includes agricultural drainage water, brackish groundwater, domestic wastewater, agro-industry wastewater, mining industry wastewater and cooling tower wastewater. However, the use of such relatively poor-quality water requires careful consideration and suitable management. Many countries have already included wastewater reuse as an important resource in their water planning. At present, several semi-arid countries, e.g., Egypt, Morocco, Jordan, India, Pakistan, Tunisia, Ghana, South Africa and the Gulf countries are using wastewater in agriculture.

Meanwhile many semi-arid countries have resorted to fish farming as a way to meet the ever-increasing demand for protein. Given the scarce water resources in semi-arid areas, the rise of aquaculture further exacerbates the water availability issue. Nevertheless, fish farms have been established in many semi-arid countries and contribute significantly to the food supply. In order to maintain sustainability, however, there may be a need to move towards integrated farming systems where the waste from one farming activity becomes the supply for another. In this context, the Food and Agriculture Organization of the United Nations (FAO) reported on 'integrated irrigated agriculture', where the productivity of water may be increased by growing fish in the freshwater of irrigation canals and using that water for irrigation as well as growing fish in the slightly saline drainage water that, eventually, can again be used to irrigate crops. Where fish farms are prohibited from using water in irrigation canals, fish can be farmed in water storage reservoirs and the water can then still be used for irrigation. This approach is also taken in the Czech Republic where large fish ponds are part of the natural environment. The fish ponds attract wildlife, allow recreational activities and are stores of irrigation water. Fish can also be grown in reservoirs that supply water for hydropower as well as for irrigation. The risk with this approach is that the environment of the fish may be adversely affected as the water level in the reservoirs may fluctuate as the result of water withdrawal.

Hence, fish farming drainage water could be a useful resource for irrigation water as well as a good source of organic matter that can improve soil quality and crop productivity, as well as reducing the costs of chemical fertilizer use. Meanwhile, the organic matter content improves the cation exchange capacity of soils, which plays an important role in supplying the plants with the nutrients. Plants are also expected to have better growth when roots take up dissolved nutrients that are

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excreted directly by fish or generated from the microbial breakdown of fish wastes. One can design a field experiment to test a number of treatments. However, that number will be limited by labour and equipment cost. Tested and verified models can be useful in that respect. Once validated against such a limited number of treatments, the models can run with a number of scenarios depicting the other possible untried treatments in the field and can finally select the optimum treatment based on the limited field treatments and the simulated treatments. Therefore, validated models that are able to predict crop growth under different water qualities, irrigation management and strategies can be very useful tools in improving water use efficiency and productivity without the need for extensive field trials.

Extension services and farmers need models to help them to decide on crop/variety selection, irrigation scheduling (when and how much to irrigate) and the expected yield under a specific irrigation system or strategy when using a certain water quality. This need can only be met with an integrated modelling approach that accounts for water, crop, climate, soil and field management and includes different crops. The SALTMED model is one of the models that has been developed for such generic applications and has proved its ability to simulate several crops under different field management. The SALTMED model has been developed to account for different irrigation systems, irrigation strategies, different water qualities, different crops and soil types, N-fertilizer applications, fertigation, the impact of abiotic stresses such as salinity, temperature, drought and the presence of shallow groundwater and a drainage system.

The 2015 version of the model allows real-time simultaneous simulation of 20 fields each of which would have different irrigation systems, irrigation strategies, crops, soils and N-fertilizers. The model simulates the dry matter production, crop yield, soil salinity and soil moisture profiles, salinity leaching requirements, soil nitrogen dynamics, nitrate leaching, soil temperature, water uptake, evapotranspiration, groundwater level and its salinity, and drainage flow. The model has been calibrated and validated with field data and proved its reliability and ability to predict the field-measured yield, dry matter, soil moisture and salinity.

The objective of this study was to investigate the suitability and benefit of using drainage water of fish farms (DWFF) in contrast to the commonly used fresh irrigation water (IW) for wheat production under the semi-arid conditions of Egypt through a field and modelling study using the SALTMED model.

In the current study, field experiments were conducted during 2014 and 2015 at the research farm of the National Research Centre (NRC) (30° 30' 1.4" N, 30° 19' 10.9" E, and 21 m + mean sea level) in the Nubaryia Region, Al Buhayrah Governorate, Egypt. The experimental area has an arid climate with cool winters and hot dry summers.

This study investigated the suitability and benefits of using DWFF, instead of canal fresh water, for wheat irrigation through a field and modelling study using the SALTMED model. Two water qualities, DWFF and IW, and four levels of N-fertigation rates [100% N (192 kg N ha-1 season-1), 80% N, 60% N and 40% N] were tested. The main physical, chemical and biological properties of drainage water of fish farms and irrigation water are reported. The results showed a positive impact when increasing N-fertigation rate on the yield using both DWFF and IW. The DWFF is richer in nitrogen, phosphorus and potassium, three elements that are macronutrients for the plants. The DWFF is also richer in micronutrients like Cu, Ni and Zn. In addition, the DWFF water has more microorganisms and organic matter than the IW water. Overall, the DWFF water is richer in terms of nutrients and biological activity than the fresh irrigation water.

However, the yield under DWFF was higher than the yield under the IW treatment by between 11 and 51% in 2014 and between 8 and 38% in 2015. This is due to the additional amount of dissolved biological nitrogen and other nutrients inherent in DWFF. The SALTMED model simulated reasonably well the soil moisture and nitrogen content of all soil layers as well as wheat dry matter, yield and water productivity for all treatments, with R^2 values of 0.99, 0.97 and 0.96, respectively.

The results indicated that there were no significant differences between dry matter values under all treatments during both the 2014 and 2015 seasons, but there were significant differences between harvest index values under all treatments during the two seasons that led to the differences in yields. The experimental results indicated that there was a positive impact from increasing the N-fertigation rate on the yield using both DWFF and IW in both seasons. However, the yield under DWFF was higher than that under the IW treatment by between 11% and 51% in 2014 and between 8% and 38% in 2015. The biggest difference was associated with the lowest nitrogen treatment. The modelling results indicated that the total N-uptake improved under DWFF when compared with IW. Similarly, the yield under DWFF treatments was higher than that under IW treatments. This is possibly due to the additional inherent amount of biological nitrogen that was present in DWFF (15 $kg^{N\ ha\text{-}1}$ in 2014 and 13 $kg^{N\ ha\text{-}1}$ in 2015) as well as other nutrients when compared with IW. The model simulated quite well the soil moisture, nitrogen dynamics, wheat dry matter, yield and water productivity for all treatments for the two seasons, 2014 and 2015. Although the yield of 2014 was greater than that of 2015, water productivity of the 2015 season was higher than that of 2014. This is mainly due to larger total irrigation water volume applied in 2014 compared with 2015.

It was concluded that the use of drainage water of fish farms instead of fresh water for irrigation of wheat could help to achieve higher yields while using less irrigation water and fewer chemical fertilizers. Additional benefits are less drainage to the drainage network and higher income for farmers. In summary, the field and modelling results indicated that the use of drainage water of fish farms has some benefits that include a higher yield as well as reduced use of chemical fertilizers. These additional benefits mean more income for farmers, less pollution of the environment and a reduction in drainage water volume that needs to be disposed off to the local drainage networks. Therefore, this study recommends the use of the drainage water of fish farming for irrigation as a good alternative or a supplement to the limited freshwater resource.

For live presentation and demonstration, please visit: https://www.youtube.com/watch?v=8NnpllMtSuE&list=PLWpC78hTAxrWz79qfHIWkHjfM-HBhRvKY

ICID Advocates Water Accounting Framework

Accounting for water resources requires an integrated framework to encompass the multidisciplinary aspect of water which can offer a basis for sustainable and equitable water distribution and allocation. Water Accounting (WA) Framework provides a standard and transparent water information source and establishes data democracy to ultimately help the policymakers, water resources experts and others to make engineering, management and other decisions pertaining to water resources. Broadly, WA may be defined as an analytical tool to quantify inflows, outflows and changes in storage as a function of time in any given hydrologic system/sub-system. WA could potentially address quantitative, qualitative, and associated potential energy characteristics of the water fluxes and storage as well as the uncertainties related to the measurements.

ICID, in cooperation with national and international organizations, organized a series of webinars on WA, which can be accessed directly from http://www.icid.org/icid_webinars_past.html.

The rationale for the 9th International Micro Irrigation Conference, 16-18 January 2019

Hosted by Indian National Committee on Surface Water (INCSW) from 16-18 January 2019, Aurangabad, India

The global population is projected to be 8.5 billion by 2030, and roughly 9-10 billion by 2050. This growing population will increasingly put pressure on natural resources, consequently threatening the global water and food security. The food security directly depends on the water availability for the agriculture sector and its judicial usage therein. Experts have projected that to satisfy the food demands of growing population by the year 2050, the food production would have to be increased by 70% to 100% in some developing countries. Additionally, the demand for water from other sectors would also be increased (nearly 55% by the year 2050) limiting the availability of water in agriculture. Hence, there is a dire need of producing more crop per drop of water in a sustainable manner so as to feed the world population in the face of climate change and its variability.

Since its introduction in the 1970s, Micro-Irrigation technologies of drip and sprinkler irrigation have emerged as the key interventions in improving the crop water productivity and ultimately water savings. The micro-irrigation systems provide water directly to the roots of the plants in the right amounts, preventing the water losses in the form of excessive runoffs and evaporation. It can double or triple water productivity – boosting crop per drop – thereby reducing the labour requirements leading to increased farmer's income compared to the conventional agricultural practices of flood irrigation. Over the last thirty years, the area under micro-irrigation methods has risen by more than 1000% to 16.5 Mha at present.

Thus, in an effort to raise awareness and to promote the use of micro-irrigation on large-scale, ICID has launched international events for Micro Irrigation Congresses commencing from the year 1971 by its member countries. The 8th conference was held in 2011 in Tehran, Iran. The 9th Micro Irrigation Conference, themed 'Micro-Irrigation in Modern Agriculture' is planned to be held at the historically rich centre of Aurangabad in India from 16-18 Jan, 2019. Organized by the Indian National Surface Water Committee, Ministry of Water Resources of India, the Conference will provide a forum and will generate opportunities for discussions. It would further deliberate strategies with eminent stakeholders through seminars, exhibitions and sessions to build public awareness for use of micro-irrigation on large-scale and to get support to implement key strategies for conservation, preservation, Intersectoral arrangements, advanced crop technology, precision engineering techniques among other interventions.

Highlights of the Event

The conference aims and plans to provide a global platform for professionals and exhibitors by showcasing knowledge and technologies from the world over and providing business to business opportunities to the water resources communities. Following high-level concurrent events are also proposed: Irrigation Minister's Roundtable; Farmer's Pavilion & NGO session; Sponsors Workshops on Specific Crops; Workshop on specific Agro Climatic Zone; and Micro Irrigation Awards to Farmer, practitioner, Company, Government

The event will showcase various programmes that include: (i) Conference; (ii) Exhibition; (iii) Supporting Events; (iv) Cultural Tour(s); (v) Technical Tour(s); (vi) Tours for accompanying person and (vii) Social Networking among others. Detailed program and further information for the event can be accessed at: http://micro-irrigation2019.com/

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International Commission on Irrigation and Drainage (ICID) established in 1950 as a scientific, technical and voluntary not-for-profit professional international organization.

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