

ICID NEWS

Managing Water for Sustainable Agriculture

MESSAGE FROM THE PRESIDENT

Dear friends and members of ICID,

As you know the General Assembly of the United Nations through its resolution has declared the year 2013 as the International Year of 'Water Cooperation'. It is emphasized that water is critical for sustainable development, including environmental security and the eradication of poverty and hunger. Water is indispensable for human health and well-being and central to achieving the Millennium Development Goals. It is expected that the International Year of Water Cooperation could play a crucial role in strengthening dialogue and cooperation at all levels.

We all are also aware that irrigation is the largest water user in many countries. ICID and our National Committees have played an important role in promoting the integrated water management and sustainable irrigated agriculture for food, fodder and fibre production. We also need to cooperate closely with other users and sectors in promoting sustainable development of the water resources.

Last year, many conferences and workshops were organized with 'Water and Food Security' as the main theme. There are range of solutions for increasing food production and achieving food security like- developing IWRM vision at regional and country levels, increasing water productivity in irrigated agriculture by adopting modernization of irrigation system and services, lowering cost of water management by promoting innovations, increasing water storages in support of irrigated agriculture by rehabilitating existing water storage facilities and developing new storage structures, promoting safe use of non-conventional waters in agriculture and aquaculture, increasing rainfed land



productivity, promoting sustainable groundwater development, strengthening support to small-holders farmers, improving food supply chain efficiency, etc.

To implement the aforesaid solutions, ICID and its National Committees should play a more active role by cooperating with all stakeholders, including UN organizations, government departments, international organizations, donors, research institutes, farmers associations and manufactures, etc. ICID has already taken a few steps in this direction. During 28-30 January, Secretary General Avinash Tyagi and I visited the FAO and IFAD headquarters in Rome to strengthen our cooperation. From 31 January to 1 February, I attended the 48th Board of Governors Meeting of WWC to discuss its strategy. I am happy to inform you that ICID is invited to be a World Water Council representative of the Steering Committee for "Promoting Water and Food Security" project initiated by the WWC and the Qatar National Food Security Programme.

As you all know that ICID is preparing to organize the First World Irrigation Forum (WIF1) in Mardin, Turkey from 29 September to 3 October 2013. The event is being organized in close cooperation with FAO, IWMI, UNESCO, ADB, the World Bank, IFPRI, etc. The 1st Meeting of the Steering

Committee of WIF was held in Ankara during 2-5 February when President Hon. Bart Schultz, Vice President Hüseyin GÜNDOĞDU, Secretary General Avinash Tyagi and I attended the meeting and also visited the venue of the Forum (see picture). I am pleased to tell you that the preparatory work for the WIF1 is going on in full swing with the dedicated efforts of the organizing committee, international technical advisory committee, and with the full support from the host National Committee (TUCID), DSI and ICID Central Office. Mardin is a historical city with very rich cultural heritages. I am confident that we will have a great World Irrigation Forum and by bringing together all stakeholders in agriculture water management, it will be our contribution to the International Year of Water Cooperation.

Finally, in the International Year of Water Cooperation, I encourage all our National Committees to enhance cooperation by promoting exchange of technical knowledge and experiences.

I wish you all a prosperous and successful year.

Yours truly

Gao Zhanyi

Dr. Gao Zhanyi
President of ICID



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ICID INVITES NOMINATIONS FOR WORLD IRRIGATION AND DRAINAGE PRIZE

ICID has been promoting sustainable irrigation and enhanced agriculture production to achieve food security around the world. ICID has instituted the **World Irrigation and Drainage Prize (WID Prize)** to recognize the work of dedicated professionals and institutions who have actively contributed to the development of 'Irrigation and Drainage' ensuring increased agricultural production at national, regional and international level. The WID Prize will be conferred upon an individual, a group of individuals or an institution without any discrimination whatsoever on the grounds of nationality, religion, race, gender, age or political belief. The Prize which includes a cash award of USD 10,000 and a 'Citation Plaque' shall be awarded every three years during the triennial World Irrigation Forum (WIF) starting from 2013. The WID Prize would be presented by the President of ICID at an official ceremony to be held during the First World Irrigation Forum scheduled to be held from 29 September to 3 October 2013 at Mardin, Turkey.

Nominations in English or in French, are invited for the first edition of the WID Prize along with all supporting documents both in electronic form and in hard copy, duly signed so as to reach to the ICID Central Office at New Delhi by 15 May 2013. The nomination in a prescribed format should be made by someone familiar with the work of the candidate and sent under intimation to the concerned ICID National Committees (please see www.icid.org) or the Government of the country where the nominee has implemented its work proposed to be considered for the Prize. A self-nomination shall not be considered. The nomination can be submitted through/ by National Committees of ICID, Governments of ICID Member countries, International organizations, and Non-governmental organizations / institution maintaining formal consultative relations with ICID, especially those concerned with the irrigation and drainage.

The candidate nominated for this prize should have made exceptionally significant contribution through innovations to promote irrigation and drainage by way of (a) research, (b) management, (c) technical services, (d) advocacy, (e) operationalization of innovations and (f) sensitization of decision

makers and public resulting in increased agriculture production at national, regional and/or international level fulfilling the following criteria:

- (i) The significant contribution must be shown to have resulted in a demonstrable improvement in the availability of agricultural water in a large area for large number of farmers, thereby increasing food production.
- (ii) The impact of the achievement must be measurable and quantifiable - demonstrated either in terms of (a) increased area under irrigation and drainage; (b) increased productivity; (c) increased efficiency in use of irrigation water; and or (d) enhanced net income; thereby improving food security and/or agricultural water security. It must be clearly shown that this increase was the direct result of the specific actions, activities and work of the nominee.
- (iii) The area covered and the extent of the change the farmers / rural population experienced in terms of quality of life and economic condition of the people of that region will be a major factor in evaluating the relative significance of the work.
- (iv) In weighing the merits of the work, consideration shall be given to attaining a balance among all segments of the irrigated agricultural production.
- (v) Weightage shall also be given to the complexity of the problem tackled, multi-disciplinary approaches adopted, and inter-institutional cooperation involved in achieving success.
- (vi) Consideration will also be given to the degree of ingenuity and determination involved in attaining this change or advancement.
- (vii) The prize will be awarded to an individual or an institution. In case where the candidate has collaborated in an indispensable way with a team, the names of the team members may be included in the nomination.



For more details like format of nomination, information/ documents to be provided, please visit

http://www.icid.org/wid_prize.html.

The nomination providing the required information along with all the attachments both in hard and electronic form should be submitted to:

Avinash C. Tyagi
Secretary General, ICID
48, Nyaya Marg, Chanakyapuri
New Delhi 110021
Email: icid@icid.org

The deadline for the receipt of the nominations is **15 May 2013**. The prize winner(s) would be encouraged to give an acceptance speech/lecture on the subject relevant to the work for which the Prize has been awarded. Such a lecture shall be organized during the Prize giving ceremony.



FROM WATER PROBLEMS TO WATER SOLUTIONS



Jeremy Bird, Director General of the International Water Management Institute (IWMI) delivered an invited lecture during the 71st Brainstorming session jointly organized by Central Board of Irrigation and Power (CBIP), International Commission on Irrigation and Drainage (ICID), and New Delhi Center of the World Water Council (NDC-WWC) at New Delhi on 8 February 2013. The following is a summary of Bird's speech:

THE REAL CHALLENGE

The greatest challenge that humanity will be facing is that of feeding 9 billion people in 2050 in a scenario of increasing land and water scarcity and unprecedented pressure on world's ecosystems. The problem is not simply of producing enough food with less water and land but it is also of addressing low levels of nutrition in poor communities and avoiding degradation of ecosystems. For instance, while the world produces enough food today, there are vast pockets of under-nutrition in places like Sub-Saharan Africa (SSA) and South Asia. The challenge is not simply of improving crop yields, but also of providing the necessary enabling frameworks for fair and equitable access. This challenge gets even more complicated in the backdrop of demand for more water and land from non-agricultural sectors of the economy; that of changing dietary patterns and aspirations of people and the increased uncertainty of climate change. For example, research shows that climate change poses risk to wheat yields in South Asia and makes water management much more complex than the present. So, the water challenge of today is not just a challenge of dwindling water quantity and quality, but of broader water governance.

EMERGING SOLUTIONS

There is a limited scope for bringing new cultivable areas and therefore 80-90% of increased production will have to come from the existing cultivated area and remaining 10-20% from the land reclamation. Higher land/crop productivity can be achieved by enhancing crop yields, double or triple cropping, installation of irrigation and/or drainage systems in irrigated and rainfed areas without a system, and modernization of existing irrigation and drainage systems.

Recognizing these challenges, there are also many reasons to be optimistic. For one, human ingenuity in the form of research, technology and behavioral changes has historically played an important role in ameliorating many of our past water and food crises. For instance, all predictions of future water use in the past have turned out to be over-estimates and actual water withdrawals were far less than estimated - partly due to the fact that higher water use efficiencies have been achieved. Similarly, historically, crop productivity has increased in all parts of the world, except Sub-Saharan Africa. Solutions thus lie in 'sustainable intensification' and actions encompassing several scales - from on farm interventions to changes in national, river basins and trans-boundary policies.

FROM RESEARCH TO SOLUTIONS

There are several concrete examples of successful interventions emanating from IWMI's field research undertaken with the governments and other partners.

IWMI's research in India for example, has led to taking up the challenge through policy interventions like - Resilience of ecosystems to become a central plank of policy, 20% increase in water use efficiency of irrigation, National Aquifer Management Programme, cutting energy losses and stabilizing groundwater levels, converting watershed management programme into a productivity enhancing instrument, management of liquid and solid waste promoted together with recycling and reuse, Indian cities and industries to reinvent their water trajectory, paradigm shift in flood management away from building more embankments, establishment of State Water Regulatory Authorities, and Model Bill for Protection, Conservation, Management and Regulation of Groundwater. The State of Gujarat implemented a program of electricity feeder segregation (JYOTIRGRAM YOJANA) which led to savings in electricity, recovery of groundwater levels and increased production. The State of West Bengal changed its age-old Groundwater Act, which led to easier access

to groundwater by poor farmers.

IWMI is endeavouring to redirect the government support to small holder irrigation, especially in Africa. The Bill and Melinda Gates Foundation (BMGF) sponsored project assessed the potential of smallholder irrigation across Sub-Saharan Africa and South Asia. A first set of impacts are - on the ground policy and investment changes in the countries of Ghana, Tanzania, Zambia, and the Indian States of West Bengal and Madhya Pradesh.

Other prominent interventions include providing tools for determining optimal environmental flows for the major river systems; informing WHO guidelines for safe use of wastewater for peri-urban agriculture based on IWMI's work in multiple cities across the globe; and revitalizing surface irrigation through further investments and capacity building of stakeholders, including the irrigation administration.

WAY FORWARD

The new IWMI-led CGIAR Consortium Research Program on 'Water, Land and Ecosystems (WLE)' will take forward the insights generated from past research and work through five strategic research programs, namely: Rainfed systems, Irrigated systems (while acknowledging that they are a part of the same continuum); Resource recovery and reuse; River basins; and Information and decision making. Underpinning this entire research portfolio will be the cross cutting theme of ecosystem resilience, gender, communication, and knowledge sharing. All water related organizations and professionals may contribute to the CGIAR's new vision of reducing rural poverty, improving food security, nutrition and wealth, while sustainably managing our natural resources. Further details about the WLE program are available at: <http://www.wle.cgiar.org/>



WATER RESOURCES AND IRRIGATION DEVELOPMENT IN TURKEY



WATER RESOURCES DEVELOPMENT

Turkey is located in the semi-arid climate zone and precipitation varies from 250 mm in the Central Antolia to more than 2500 mm in the coastal areas. The country has 25 river basins and the annual average precipitation is 501 billion cubic meters (BCM), of which 112 BCM could be economically exploited (Table 1).

Table 1. Land & water resources of Turkey

Geographical area	78 million ha
Arable land	28 million ha
Economically irrigable land	8.5 million ha
Presently irrigated	5.6 million ha
Population	75 million
Precipitation	501 BCM
Total exploitable water resource	112 BCM
• Surface water	98 BCM
• Groundwater	14 BCM

The per capita water availability in 2010 was 1600 m³ per year and is likely to be 1125 m³ in 2023. It is therefore imperative to improve the water availability in order to enhance the quality of life. The water resources and water structures have always been driving forces in the development of modern water management and welfare of Turkey and its neighbouring regions. In Turkey, systematic water resources development started in the 1950s with the establishment of the General Directorate of State Hydraulics Works (DSI). Since then Turkey has made great strides in construction of dams for domestic water supply, irrigation, power generation, and flood control. Today, there are around 1630 dams in

Turkey has a rich history as the cradle of civilization for thousands of years. Agriculture sector in Turkey is crucial for the economic development as it employs 30% of the country's workforce and contributes 8% to GDP. While agricultural production depends greatly on irrigation, irrigated agriculture is the major user of freshwater and this use will be doubled in coming decade. Turkey has made great strides in changing its water policy and actions towards sustainable development and efficient management of its water resources. Dr. Hüseyin GÜNDOĞDU, ICID Vice President and Planning Engineer in DSI provides an update on Turkey's progress in water resources and irrigation development. ICID will be organizing its 1st World Irrigation Forum (WIF1) in Mardin, Turkey in coming September-October. We hope that this brief will be of interest to our readers.

operation and under construction. Of the, 870 large dams, 692 are in operation and the remaining are under construction.

Recently, water security has become a major concern for many countries, especially for those located in arid and semi-arid regions such as Turkey. Available water resources should be used in a smart and planned manner in consideration of efficiency and environmental requirements for the sustainable development. During the drought years, water scarcity impacts adversely on the social and economic activities of the inland areas having intensive agricultural activities; while the coastal areas are affected by flood disasters. Presently, Turkey utilizes around 50% of its potential exploitable water resources and contemplates to utilize all of it during the next 10 years by 2023 which is the 100th anniversary of the republic (Figure 1).

Although the irrigation water demand in 2023 is likely to be double from the present,

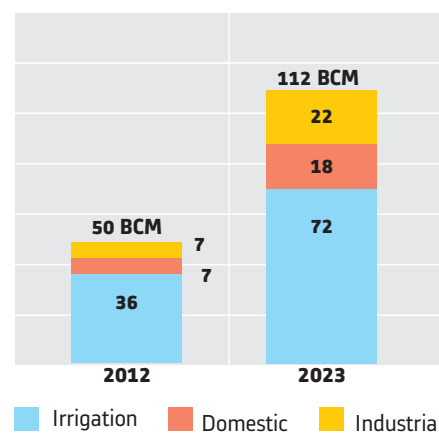


Figure 1. Water demand by different sectors in 2012 and 2023

however, its share in total water demand will decrease from 72% now to 64% by 2023.

BOOMING AGRICULTURE SECTOR

The agricultural sector has been the largest sector in terms of employment, and a major contributor to the country's GNP, exports and industrial growth. The Turkish agricultural policy is set out in successive five-year development plans. The development plans are mainly focused on stabilizing agricultural prices, providing adequate and stable income for those working in agriculture, meeting the nutritional needs of a fast-growing population, increasing yield, minimizing vulnerability of production due to changing weather conditions, promoting development in rural areas, promoting the application of modern agricultural techniques and developing an export potential for agriculture. The expansion in agricultural exports during the last decade was a consequence of this planning process. In the recent years, farmers prefer to grow crops like maize, cereals, cotton, fruits and vegetables. Turkey is the largest producer and exporter of agricultural products in the near and North Africa region as well as Europe. Turkey produces 80 types of fresh fruits and vegetables, of which 50 types are exported. Most of the agricultural produce comes from the irrigated farming.

IRRIGATION AND DRAINAGE

Since the agriculture is an important sector of Turkey's economy, the Government pays much attention to irrigation infrastructure investment and irrigation management within the framework of integrated water management concept. Presently, 5.6 million ha of the 8.5 million ha economically irrigable land has been equipped with irrigation facilities. The remaining area will be brought under irrigation by 2023.



While Turkey continues making major investment in the irrigation infrastructure by opening new irrigation area, there is an equal focus on increasing water use efficiency for saving water through system improvements and managerial interventions. In order to achieve this objective, since 2003, there has been a shift from the construction of open channel to piped conveyance system.

In order to prevent harmful effect of waterlogging and to ensure the sustainability of agriculture, the drainage system has been integrated in to DSI irrigation schemes. In this regard, 6771 km main, 7768 km secondary, and 9386 km tertiary drainage canal network has been built. The water table fluctuations and the quality of groundwater in irrigation command areas are periodically monitored to determine the performance of the installed drainage system. Water table observation practices in irrigation schemes were initiated in 1966 and are still carried on about 1.062 million ha.

IRRIGATION MANAGEMENT TRANSFER

The operation and maintenance activities (O&M) of irrigation schemes were carried out by the governmental organizations till early 1990s. Subsequently, the governmental organizations have been mandated to transfer O&M of irrigation systems to Water User Organizations (WUOs) such as Village Administrations, Municipalities, Cooperatives and Water User Associations (WUAs). The Government had launched a program to transfer O&M responsibility for secondary and tertiary canals to WUOs. However, by 1993, about 70,000 ha could be transferred to various types of Water User organizations.

In order to perform O&M of irrigation and drainage infrastructure more efficiently by

involving farmers' participation, the transfer process gained momentum in 1993. Presently, 97% of all irrigation networks are operated and maintained by the WUOs. The Irrigation Management Transfer (IMT) programme of Turkey is recognized as a good example of implementation for the other developing countries.

In order to keep sustainability and service quality, the government; enacted a new WUA law in 2011, developing alternative models for farmers' participation to new investments (BOT model), preparing new programs for modernization and rehabilitation of irrigation systems, implementing training programmes for technical assistance, etc.

THE GAP, KOP AND DAP PROJECTS

Besides irrigation and drainage investments, the Turkish Government has been emphasizing on regional development projects such as South-eastern Anatolia Project (GAP), Konya Plain Project (KOP) and Eastern Anatolia project (DAP).

The GAP is a large multi-sectoral regional development project aimed at the full-fledged socio-economic development of south-eastern Region, known historically as 'Upper Mesopotamia' which has witnessed some of the earliest civilizations in the world. The GAP includes 22 dams, 19 hydropower projects, 1.058 million ha irrigation area and 9 domestic water supply schemes and is one of the largest investments in the history of the Turkish Republic. GAP provides 17% of hydroelectric potential of Turkey (36.7billion kWh/year). Upon completion of the GAP project, the contribution to the national economy is estimated at USD 6.61 billion annually and the direct employment opportunity will be provided to 1,270,000

people. Atatürk Dam was completed in 1990s has a total storage capacity of 48.7 BCM and installed electricity generation capacity of 2400 MW.

Konya Plain Project (KOP) consists of 14 irrigation projects, one domestic water supply and one energy project. Upon completion of the KOP, the contribution to the national economy will be USD 2.570 billion and employment opportunity to about 0.1 million people. The project is planned to irrigate 1.1 million ha, and will provide about 164 million m³ to domestic water needs, and generate 3.06 billion kWh annually. Presently about 76% of KOP irrigation projects are in operation.

Eastern Anatolia Project (DAP) area covers 20% of geographical area, 16 provinces and 8% of Turkey's population. It is planned to irrigate 1.22 million ha. The DAP includes 30 irrigation, drainage and reclamation projects, 3 hydropower projects and 2 domestic water supply projects. Presently, 35% of irrigation projects are in operation. The project is expected to contribute USD 1.418 billion to national economy and some 1.22 million people will get employment.

Turkey has already initiated a project called "1000 pools in a 1000 days / POOL-WATER PROJECTS" aiming to realize irrigated farming in a short time period in rural areas left out of big irrigation projects. As per the project, 1025 water storages to store 1.641 billion m³ and to irrigate 305,710 ha has been planned. With realization of the project 300,000 people will get local jobs and will discourage migration from rural to urban area. The project is likely to generate USD 506 million annually besides the control of flood damages and soil erosion.





IQTM

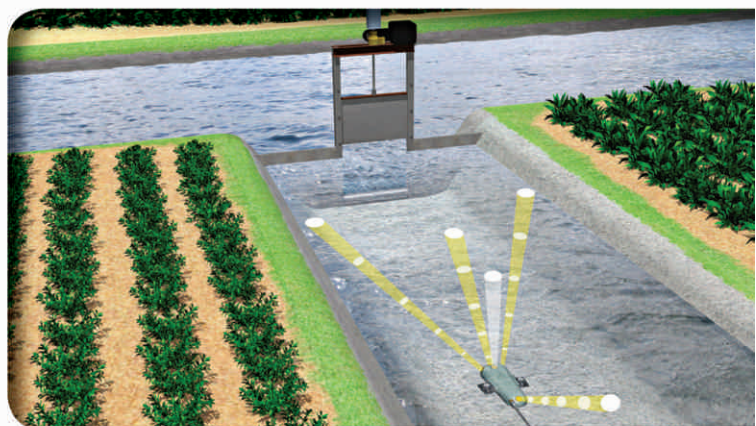
Pronunciation: /,i- 'ky{uuml}/

Function: n

Definition: [i - intelligent q - flow]

a: term used to express the superior intelligence in an acoustic Doppler measurement device;

b: a score on a standardized intelligence test determined by extraordinary data collection capabilities relative to the average performance of other flow meters.



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PRIVATE SECTOR STEWARDSHIP IN AGRICULTURAL WATER MANAGEMENT

The Indian states of Haryana and Punjab are the heartlands of the world famous "Basmati Rice" growing areas and contribute 70% food grain to the central pool of India. Basmati Rice requires high atmospheric humidity during vegetative growth, cooler nights during flowering period, and short days during crop maturity infusing aroma and good cooking quality. These states are endowed with ample natural resources and conducive climate for production of Basmati variety of rice. Farmers are inclined to grow rice and find it remunerative due to Government's policy of providing reasonable minimum support price (MSP). So also, due to non-availability of the similar support prices for other crops like oilseed and pulses, farmers are not diversifying their cropping pattern.

Conventionally, rice paddy cultivation in Haryana and Punjab uses 17000 to 20,000 cubic meters of irrigation water per ha during crops growing period of 80-85 days. This involves growing nursery, puddling of fields, and flooding of rice fields. Ironically, these states are facing crisis of water shortage owing to excessive withdrawals of the groundwater and excessive application of water to rice crop. The depleting groundwater resource has been simply a matter of debate but not much is done in action. Customarily, it is taken for granted that the groundwater beneath the land is one's own property and the land owner can pump out as much water as possible without any restrictions. The wealthy farmers are deepening their tubewells in the quest of groundwater, extracting from the common aquifer by depriving poor farmers. In this race the small farmers are the losers and are compelled to either lease out or sell their land to big farmers. At the same time, the small farmers with limited holdings are unable to take advantage of advanced technologies such as laser field leveling in increasing production and optimizing resources inputs.

This challenge was taken up by Dunar Foods Limited¹ in collaboration with International Finance Corporation (IFC) by promoting improved water management technology and tools among farmers belonging to three districts of Karnal, Kaithal and Kurukshetra in

Technologies that can be put to practice require collaboration and convergence among various players. Small holder farmers with limited political and economic clout fail to take advantage of the new technologies. Ms. Shweta Tyagi, Executive Secretary, India Water Foundation, New Delhi provides an encouraging case that makes the technology work for the small holder farmers through a Consortium approach by promoting water saving technology leading to sustainable rice production. The 'Agriculture Service Technology Providers' established through the consortium served the small holder farmers to meet their technology needs. The example shows how a private company engaged with the local government agencies and farming communities and introduced the new technology in achieving sustainable use of scarce water resources, enhancing smallholder farmers' income, besides promoting their own business.

Haryana, India through a 'Water Saving Consortium'.

The no till technology used in conjunction with dry rice seeding without the practice of transplantation helped save total irrigation water requirement. The use of laser land levelers increased the on-farm efficiency; rice was directly sown in the field using the dry seeder, while the happy seeder was used to sow wheat in the paddy harvested fields having stubbles. The consortium provided a Laser Land Leveler (Figure 1), Dry Rice Seeders (Figure 2), and Turbo Happy (no till) Seeders (Figure 3) to Agriculture Technology Service Providers (ATSP) in the villages so that farmers could easily use them on custom hire basis. Farmers are being motivated through travelling seminars and spot discussions to adopt water saving technologies.

This led to optimum use of water in about 320 ha rice grown area with an estimated saving of 2.8 million cubic meters of groundwater in one season. This water saving was achieved without decrease in the rice and wheat yields. With the package of improved water management technology, an overall cost saving of Rs.7500 (about USD 150) per ha was achieved. Besides water saving, the improved technology has saved the environment from the hazards of burning huge quantity of rice stubbles in the harvested fields.

Ms. Shweta Tyagi can be contact at <shwetatyagi@indiawaterfoundation.org>



Figure 1. Laser Land Leveler



Figure 2. Dry Rice Seeder

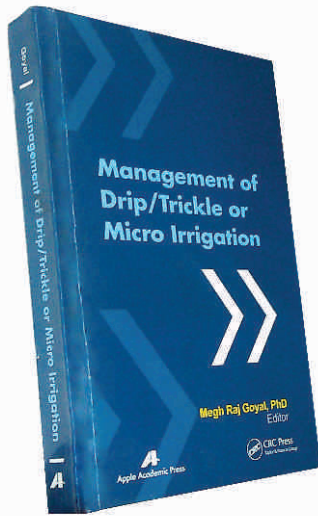


Figure 3. Turbo Happy Seeder



¹ Dunar Foods Limited is among the largest processors and exporters of Basmati Rice in India (www.dunarbasmatarice.com).

NEW PUBLICATIONS



The use of sprinkler and micro irrigation technology is steadily increasing all over the world. Today, about 42 million ha are irrigated by various types of sprinkler

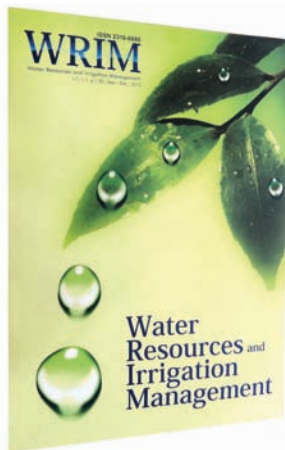
Management of Drip/Trickle or Micro Irrigation

irrigation and some 10 million ha are under micro (drip/ trickle/ micro sprinkler) irrigation across the world. In many countries due to increasing demand from industrial/ energy and domestic sectors, there is a pressure to reduce water withdrawal for agriculture. In countries located in the arid and semi-arid regions, governments are promoting the use of pressurized irrigation especially micro irrigation. The top 10 countries in adoption of micro irrigation are India, China, Spain, USA, Italy, South Africa, Brazil, Iran, Australia and Mexico. In these and many other countries, the micro irrigation area is likely to be expanded further.

With the above background, a recent book titled "Management of Drip/Trickle or Micro Irrigation" by Prof. Megh Raj Goyal (Editor), and Professor in Agricultural and Biomedical Engineering, University of Puerto Rico-Mayaguez Campus is a timely addition to the micro irrigation literature. This book, besides

the basics of soil-water-plant interactions, includes topics such as methods for soil moisture measurement; evapotranspiration; principles of drip/micro/trickle irrigation; filtration systems; automation; chlorination; service and maintenance; design and evaluation of drip system; economic analysis for selecting irrigation technology. The most important contribution of this book is the glossary of technical terms and the chapter-wise rich bibliography containing large number of citations of the books, bulletins, proceedings and technical papers. We hope that students of agricultural engineering, teachers, researchers, system designers, farm managers will find this book useful. The book can be obtained at - Apple Academic Press, Inc. 9, Spinnaker Way, Waretown, NJ 08758, USA. Tel: 732-9985302, E-mail: info@appleacademicpress.com, Website: www.appleacademicpress.com

Journal of Water Resources and Irrigation Management



The newly launched Water Resources and Irrigation Management (WRIM) Journal is a joint technical and scientific collaboration effort between the Brazilian National Institute of Semiarid and the Federal University of Recôncavo of Bahia.

The Journal's main objective is to share scientific information with the national and international communities, mainly in topics related to water resources management and irrigated agriculture, having in mind the sustainability of crop production under scenarios of limited water availability.

WRIM is published quarterly by Universidade Federal do Recôncavo da Bahia and Instituto Nacional do Semiárido with the objective of disseminating original and unpublished technical and scientific articles written in English, Portuguese or Spanish in the areas of climatology and hydrology, irrigation and drainage engineering, crop and water management, quality and reuse of water, planning and management of water resources and climate change, water resources and agriculture.

We congratulate the eminent team of the Editorial Board for this new initiative as this will provide a wealth of research findings and new knowledge about water resources and irrigation management emanated in South American countries to the entire irrigation and scientific community across the world.

For subscription enquiry and/ or contribution of papers, please contact Water Resources and Irrigation Management, Núcleo de Engenharia de Água e Solo, Centro de Ciências Agrárias, AMBIENTAIS e Biológicas, Universidade Federal do Recôncavo da Bahia, RuaRuy Barbosa, 710, CEP 44380-000, Cruz das Almas - Bahia - Brazil, Tel/Fax: (75) 3621-2798, E-mail: wrim@wrim.com.br, wrim.water@gmail.com; Website: www.wrim.com.br.



EDITOR

Dr. Suresh A. Kulkarni

Executive Secretary,

ICID Central Office, New Delhi, India

Tel: +91-11-2611 6837/5679, E-mail: icid@icid.org



ICID-CIID

International Commission on Irrigation and Drainage (ICID) was established in 1950 as a scientific, technical and voluntary not-for-profit non-governmental international organization. The ICID News is published quarterly by ICID Central Office, New Delhi, India.