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ICAR-IIWM News

ICAR-IIWM

ICAR - Indian Institute of Water Management

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DIRECTOR'S COLUMN |

Integration of Remote Sensing and Artificial Intelligence: The Emerging Tool for Agricultural Water Management

The global climate change in general and the skewed distribution of the Indian monsoon rainfall in particular offer fresh challenges to produce more with less water to ensure food security for burgeoning population of the nation. The inherent diversity of soil, climate and topography of the country necessitates location-specific water management practices in agriculture, for which the spatio-temporal data requirement is a major concern. In fact, the scientific manpower and material involvement to generate a representative dataset is a costly proposition and time consuming. In other hand, since the beginning of the twenty-first century, several earth observing satellites have revolutionized the process of monitoring earth's resources and provide the information on and below the surface through remote sensing (RS). The objective information collected on agricultural and hydrological conditions of lands using RS technique has a great potential for improving land and water productivity in agriculture.

While recent satellite missions, such as, Soil Moisture Ocean Salinity (SMOS) and Soil Moisture Active Passive (SMAP) have used passive microwave techniques to estimate soil moisture at a spatial resolution of 25 to 40 km, the European Space Agency's Climate Change Initiative (ESA CCI), incorporating various new satellite sensors, provides the longest global soil moisture dataset since 1979. From agricultural water management prospective, it is important to apply various computational tools to downscale and improve the spatial resolution at management scale for research and application. NASA's Gravity Recovery and Climate Experiment (GRACE) satellite mission since 2002 has proved its immense application in estimating the terrestrial water storage and groundwater storage in different parts of the world in spite of its low spatial resolution, particularly appropriate at the large basin scale. Our institute, ICAR-IIWM, has employed the GRACE gravity solutions during 2002 to 2014 to assess the water storage changes in India. We also, for the first time, validated this satellite derivation relating with the in situ groundwater level across the Ganges Basin, which exhibited reasonable consistency. Furthermore, our research findings suggest GRACE records can also be used for heat stress assessment in a region.

In the scheme of crop water management, a good first step towards efficient water management is to quantify crop evapotranspiration (ET_c), which has recently been modelled by surface energy balance using the inputs from the high resolution satellite images, such as Landsat. This satellite, along with the MODIS, also provides information about the vegetation properties, considering the surface reflectance from two or more wave lengths. Nevertheless, applicability of these satellite retrievals depends on validating and then combining with the observation from field experiments or sensors or drones. Notably, our institute has set up eddy flux towers to monitor exchanges from terrestrial ecosystems to the atmosphere, and the output can be used for validation of satellite data. Further, RS has played a vital role in delineation, planning, monitoring and management of watersheds, command areas and water logged areas, in which our Institute has contributed a lot in national level.

In recent years, Artificial intelligence (AI) has been emerged as an effective tool that enables us to rethink on integration of information, analyze of data, and use of the resulting insights to improve the decision making. The application of the technique in water management could generate a better understanding and monitoring of complex problems in hydrological systems. The developments in machine learning algorithms can optimally store, process and disseminate the continuous and large flow of data from satellite or from sensors, with the help of new technologies such as internet, cloud computing etc. Important machine learning tools used in modelling and forecasting in water resource management are artificial neural network (ANN), support vector machine (SVM), and wavelet techniques. Their hybrids, for example, the wavelet-artificial neural network (WA-ANN) and wavelet-support vector regression (WA-SVR) have also been used in forecasting and management of surface and groundwater resources. While RS can yield a vast amount of continually refreshed 'big data', AI can accelerate the discovery of complex pattern in big data and suggest some scientific processes. Combining these mutually reinforcing techniques could help in taking the best decision for efficient and sustainable water management in agriculture.

Concept : **Dr. S.K. Ambast**

Compiled, Edited and Layout Design :

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RESEARCH ACHIEVEMENTS

Index-Based Flood Insurance (IBFI) and Post-flood Management to Promote Agriculture Resilience

Flood is a natural disaster that imposes severe challenge to food security. The prime reasons for flood occurrence include extreme rainfall events, excess release of water from dams, cloudburst, impeded drainage and excessive snow melt. India is one of worst affected nations exposed to flood hazard globally. Bihar and Odisha accounts for about 12.7% and 4.2% of total flood prone area of India (40 million ha.), respectively. Flash floods is the major proportion of total flood events in these areas.

To develop / suggest flood resilient agricultural practices and adaptation measures, we selected Gaighat block of Muzaffarpur district in Bihar that is highly suceptible to floods. The flood occurs due to heavy rainfall coupled with poor drainage in this area. The flood water remains in agricultural fields for 6-10 days causing severe damage to kharif crops, mainly rice. The past experience of flood occurrence in Indian states reveal that the time of incidence, submergence depth and duration are critical factors which vary significantly and hence pose serious challenge to flood management. There is a need to develop a technological support base to enhance the quality of assessment of extent and duration of flood water in the agricultural fields under Pradhan Mantri Fasal Bima Yojana (PMFBY). This will assist in making accurate insurance payout to the farmers as per their crop damage In several instances, the crop gets fully damaged and there is a strong need to improve the preparedness of the farmers to take up an alternate crop suiting to the land situation. This necessitates us to device a crop management strategy for post flood environment.

Muzaffarpur district of Bihar comes under agro-climatic zone no. IV of Middle Gangetic Plain Region. It has about 3,15,000 ha of geographical area and 2,19,000 ha of net sown area with a cropping intensity of 130%. It receives an annual rainfall of 1196 mm in 57 rainy days mainly during June-October. Owing to extreme climatic rainfall events, this district is extremely susceptible to floods. Rice and maize are major crops grown during kharif season. The flood frequency and it's extent in this district were analyzed for identification of most severely flood affected areas and for devising the post-flood management strategies under different scenarios (http://www.iiwm.res.in/publication.php). The critically flood affected blocks of Muzaffarpur district identified were Aurai, Bandra, Bochaha, Gaighat, Katra, Kurhani, Marwan, Paroo and Sakra.

During kharif 2017, initial field survey was conducted to assess the crop damage in flood affected areas of Gaighat block (Six villages-Bhagavatpur, Ladaur, Balaur, Paga, Bhatgama, Madhurapatti) and found that rice and maize were severely damaged due to flood. Flood water remained in the fields for about 30-45 days and depth varied between 0.3 to 1.4 m. Due to flood, tillering mortality in rice fields ranged between 15-80%. Moreover, maize and vegetable crops were completely damaged. The stage-wise crop damage in operational area was assessed in terms of both flood-duration and extent. Out of the 200 farm households involved in pilot-testing, 43 farmers were paid compensations ranging between ₹ 7000/- to ₹ 20,000 ha^{-1} as per the index based flood insurance.

During second week of November 2017, we prepared post-flood management plan that was implemented after receding flood water. Seeds of hybrid maize and vegetables (brinjal, tomato and cauliflower) were provided to the affected farmers and were sown / planted after flood and an impact study was conducted. It was observed that farmers could generate additional net returns of about ₹ 16,700 ha^{-1} due to timely sowing of alternate crops and implementation of post-flood management plan compared to control (flood damaged field without any intervention). The maize hybrid (var. Shaktiman-3) yielded an average cob yield of 2.82 t ha^{-1} under post-flood environment. It has provided better income to the farmers compared to late wheat sowing that resulted into lower yield, higher pest and disease incidence under post-flood scenario. Few farmers were provided with brinjal, tomato and cauliflower seeds and they got on an average yields of 13.3 t ha^{-1}, 16.7 t ha^{-1} and 14.1 t ha^{-1}, respectively.

Flood at Gaighat block, Bihar

Damaged paddy fields (After recession of flood water)

Farmers-Scientists interaction

Maize crop with post-flood management strategy

P.S. Brahmanand, S. Roy Chowdhury, S.K. Jena, S.K. Ambast, A.K. Singh, B.P. Bhatt, G. Amarnath and A.K. Sikka

Efficient Groundwater Management for Enhancing Adaptive Capacity to Climate Change in a Sugarcane Growing Area

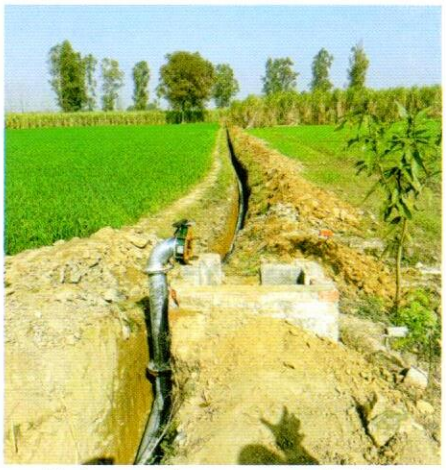
Increasing population, urbanization and industrialization coupled with climate change leads to increased competition for natural resources such as land and water. Indian agriculture, on which huge population of the country is dependent upon, is highly vulnerable to climate change. Uttar Pradesh, the most populous state of India, has over 200 million inhabitants and situated in Gangetic plain region. Further, Muzaffarnagar is a western district of Uttar Pradesh, located in the middle of highly fertile upper Ganga-Yamuna Doab region. Around 63% of its population depends on the agriculture as their main occupation. This district being one of the highest producer of sugarcane in the country, is known as 'Sugar bowl of India'. The water resource of the district is in extremely vulnerable condition due to indiscriminate use of groundwater for irrigating water guzzling sugarcane crop. This has resulted in decline of groundwater level at an alarming rate (around 1.0 m per year) especially in three

blocks (Shahpur, Budhana, Baghra), which are declared as the over exploited blocks or dark zone.

A two pronged approach i.e., supply side management and demand side management was followed in a study village, namely Rasulpur Jattan located in Sahapur over exploited block to overcome the problem of decline in groundwater table. In order to have improved delivery and application of irrigation water, climate resilient irrigation system such as underground conveyance pipeline, drip & raingun systems were installed in the farmers cropped field. Further, for augmentation of groundwater resource, water storage structures i.e. check dams and artificial groundwater recharge cavity wells near to the water storage structures and natural streams were constructed.

In order to assess the impact of climate change on groundwater dynamics in future years, water budgeting was carried out for future years for the study village. Climatic data for future years (2020, 2030, 2040, 2050, 2060, 2070, 2080 and 2090) were collected from the MarkSim Global Climate Model (GCM) at Representative Concentration Pathway (RCP) - 4.5 using the model developed at Geophysical Fluid Dynamics Laboratory (GFDL) – Global Coupled Model-CM3. Future water demand for agriculture was assessed for the study village, initially for five different scenarios considering demand side management parameters i.e., area under different crops (sugarcane, wheat, paddy, sorghum, black gram, mustard and berseem), provision of underground pipeline conveyance system, use of improved irrigation application methods such as drip and raingun etc. Subsequently, two more scenarios were developed considering supply side management i.e., use of recharge cavities for recharging groundwater in the village. The scenarios considered are (a) scenario 1 (Business As Usual), (b) scenario 2 (50 % reduction of sugarcane cultivated area), (c) scenario 3 (50 % of total cultivated area is considered having provision of underground pipeline conveyance system and improved irrigation methods such as drip and raingun system, (d) scenario 4 (combination of scenario 2 and 3 where the sugarcane cultivated area is reduced by 50 %, and 50 % of total cultivated area is considered to have conveyance pipeline system and improved irrigation methods such as drip and raingun system), (e) scenario 5 (100% sugarcane cultivated area is considered to be provided with underground conveyance pipeline system and improved irrigation methods), (f) scenario 6 (combination of scenario 4 along with provision of recharge cavity wells of different densities i.e. one cavity in each 100 ha of land, one cavity in each 75 ha of land and one cavity in each 50 ha of land), (g) scenario 7 (combination of scenario 5 along with provision of recharge cavity wells of different densities). The irrigation water demand for the scenario 6 and scenario 7 remains same as that of scenario 4 and scenario 5, respectively.

From the analysis it is found that the irrigation water demands for different scenarios have been reduced from Business As Usual (BAU) scenario due to adaption of various water saving interventions. By adaptation of scenario 4 and scenario 3, irrigation water requirement can be reduced to 46.7 % and 23 % respectively. It is observed that the decline in groundwater depth is maximum for BAU scenario and minimum for scenario 6 (iii) where one recharge cavity was considered in each 50 ha of land along with scenario 4 (Fig. 1).



Underground conveyance pipe line

Drip irrigation system in farmer's field

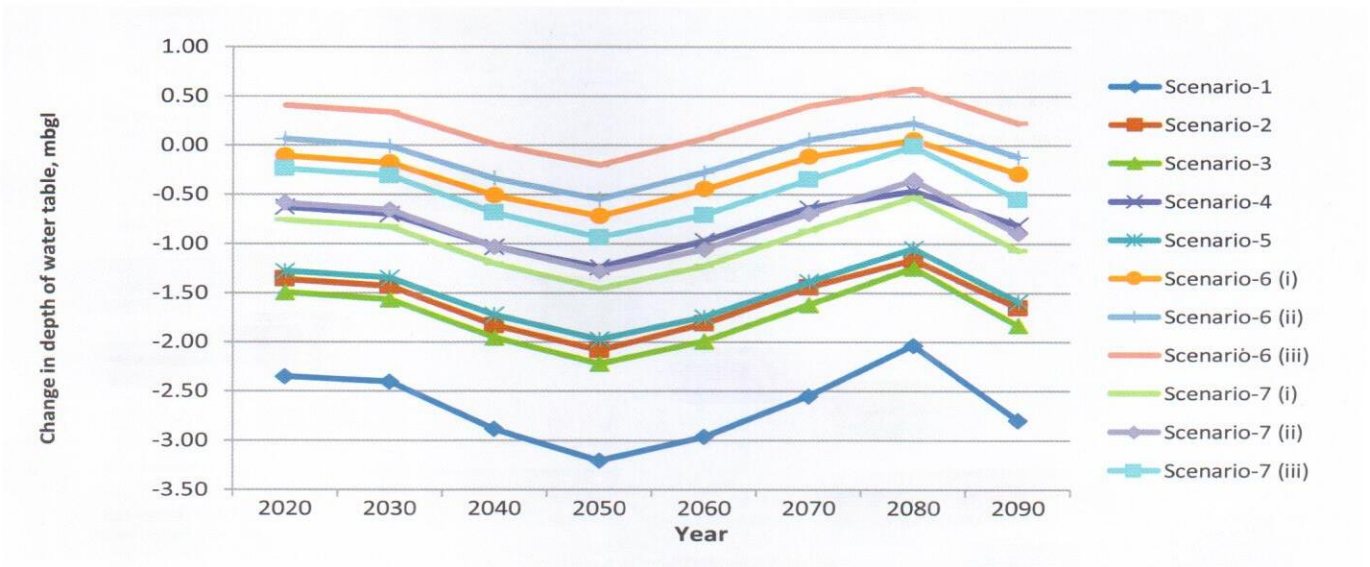
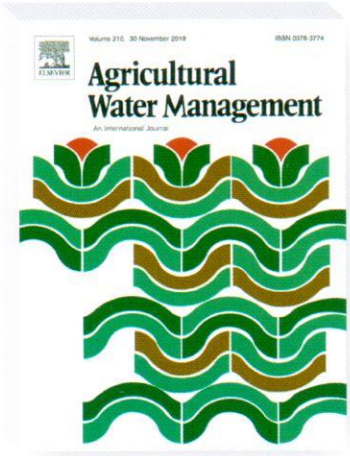


Fig. 1 Change in depth of groundwater table for future years

The study concludes that with adopting different climate resilient irrigation systems (underground pipeline, drip and raingun systems) and changing cropping pattern, irrigation water to the tune of 50% can be saved in the village by minimizing the water wastage in the agricultural field. The groundwater recharge through cavity well is found to be an appropriate method for groundwater development. The analysis recommends for reduction in area under sugarcane cultivation coupled with shifting of more area from traditional surface irrigation to pressurized irrigation, and constructing artificial recharge structures to reverse the groundwater table decline trend in the study village.

A. Mishra, S. Mohanty, R.R. Sethi and P. Panigrahi

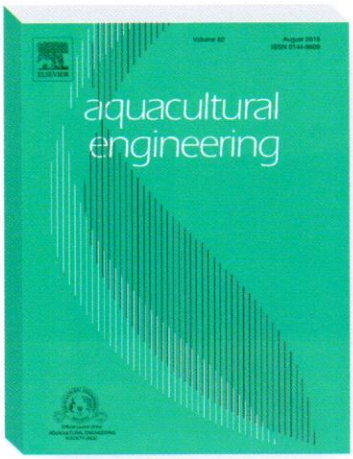
SCIENCE



Yield and Water Productivity Improvements through Modifying Rice Cultivation Practices and Water Management

Achieving higher productivity in irrigated rice production is becoming ever-more important. A modified rice cultivation method, the System of Rice Intensification (SRI), recommends keeping rice fields moist but unflooded during the crop's vegetative stage, usually with alternate-wetting-and-drying (AWD), then maintaining shallow flooding during the post-vegetative stage of crop growth. However, scientist from ICAR-IIWM found no evidence as such available on how flooding paddy fields continuously vs. alternately during the post-vegetative stage under SRI influences the crops' physiology, root growth, grain yield, and water productivity. Therefore, they conducted field experiments to investigate the impacts of two alternative crop management systems, namely, SRI and conventional management practice (CMP) under different water management treatments during the vegetative stage [continuous flooding (CF) vs. AWD] and then during post-vegetative stage: CF vs. AWD @ 1-DAD (days after disappearance of ponded water), 3-DAD or 5-DAD. Interestingly, results showed that SRI practices, compared to CMP methods, significantly improved plants' root growth and xylem exudation rate, leaf area index and light interception by the crop canopy, plus photosynthesis rate at the grain-filling stage, resulting in higher grain yield. Overall, this modified method of rice crop management produced 58% high ergrain yield with 16% less water. Across all water management treatments, significantly more grain was produced per unit of water applied with SRI management (6.3 kg ha-mm^{-1}) compared to CMP (3.3 kg grain ha-mm^{-1}). The highest grain yield with SRI (6.2 t ha^{-1}), and the greatest water productivity (6.7 kg ha-mm^{-1}) were obtained with SRI and 3-DAD post-vegetative irrigation. With CMP, highest grain yield (4.1 t ha^{-1}) and water productivity (3.5 kg ha-mm^{-1}) were with 1-DAD irrigation. Differences measured in plants' response to modified management practices and alternative irrigation schedules indicated how phenotypic and physiological performances can be improved for a given genotype. They reports that combining changes in crop and water management can improve water productivity as well as grain yield.

Adapted from Amod K. Thakur, Krishna G. Mandal, Rajeeb K. Mohanty, Sunil K. Ambast 2018. Rice root growth, photosynthesis, yield and water productivity improvements through modifying cultivation practices and water management. *Agricultural Water Management 206*: 67-77. View the full article online at https://doi.org/10.1016/ j.agwat.2018.04.027



Enhancing Water Use Efficiency in Pacific White Shrimp Culture

Shrimp aquaculture is a highly lucrative farm enterprise and livelihood option for a large number of farmers in coastal India and most Asian countries. The future expansion of shrimp culture requires responsible management to increase operational efficacy and help avert wasteful use of water through water cutback approach. With increasing scarcity of water resources and threats to environment pollution, studies are needed to determine the ideal amount of water necessary for successful shrimp culture. Keeping in view the significance of water budgeting, scientists at ICAR-IIWM examined different aspects of hydrological water balance study to quantify water requirement and water use efficiency. In Litopenaeus vannamei culture, minimization of total water use (3.25×10^4, m^3) and water exchange (0.63×10^4, m^3) at optimum stocking density of 50 post-larvae m^{-2}, is perceived as a way to improve productivity (10.58 t ha^{-1}120 d^{-1}), CWUI (1.72), WUE$_c$ (0.58 kg m^{-3}), total water footprint (1,229 m^3 t^{-1} biomass), NCWP (USD 1.28 m^{-3}) and OV-CC ratio (1.97). Further, shrimp farming with demand driven low to moderate water exchange, not only serves to keep the water quality suitable for growth, but also improves water use efficiency and helps in minimizing the quantity of sediment load (45.3 m^3 t^{-1} biomass) and effluent outputs (0.63×10^4, m^3). The knowledge derived from this study would provide the basis to optimize shrimp rearing efforts in minimizing wasteful use of water, production cost and enhancing the production performance, water productivity and water footprint in monoculture of L. vannamei with changing intensity levels.

Adapted from Rajeeb K. Mohanty, S.K. Ambast, P. Panigrahi, A.K. Thakur, K.G. Mandal 2018. Enhancing water use efficiency in monoculture of Litopenaeus vannamei: Impacts on pond water quality, waste production, water footprint and production performance. *Aquacultural Engineering*, 82: 46–55. View the full article online at https://doi.org/10.1016/j.aquaeng.2018.06.004

RESEARCH MEETINGS

3rd Meeting of Seventh Research Advisory Committee (RAC)

Members of Seventh RAC of ICAR-IIWM, Bhubaneswar

Dr. T.K. Sarkar, Former Project Director, WTC, ICAR-IARI, New Delhi	Chairman
Dr. A.K. Misra, Former Head, Division of Soil Physics, ICAR-IISS, Bhopal	Member
Dr. P.K. Mahapatra, Former Dean, College of Agriculture, OUAT, Bhubaneswar	Member
Dr. M.K. Jha, Professor, IIT, Kharagpur	Member
Dr. V.U.M. Rao, Former Project Coordinator, AICRP on Agro-meteorology	Member
Dr. S.K. Chaudhari, Asst. Director General (S&WM), ICAR, New Delhi	Member
Dr. S.K. Ambast, Director, ICAR-IIWM, Bhubaneswar	Member
Dr. S. Roy Chowdhury, Principal Scientist, ICAR-IIWM, Bhubaneswar	Member Secretary

The third meeting of 7th Research Advisory Committee (RAC) of ICAR-Indian Institute of Water Management, Bhubaneswar was held during February 23-24, 2018 under the chairmanship of Dr. T.K. Sarkar. Dr. S.K. Ambast, Director, ICAR-IIWM welcomed esteemed Chairman and all members of RAC and presented research accomplishments of the Institute. Action taken report (ATR) was presented by Dr. S. Roy Chowdhury, Principal Scientist and Member-Secretary, RAC. Theme-wise presentations were also made by theme leaders of different programs. Some of the recommendations were as follows:

- Specific action plans on drip-fertigation and other water management interventions to be prepared.
- Development of innovative and farmer's friendly-economically viable technology, their up-scaling and demonstration across different agro-ecosystems aligning with state department. Also its methodologies be duly addressed in water policy and governance.
- Specific drainage guidelines for waterlogged areas in eastern India to be developed.
- Block-level drought and flood management interventions to be prepared.
- Training programs have to be more skill oriented with practical sessions.
- Water conservation, efficient and diversified use and environmental impact warrant attention under PMKSY.
- Enhancement of water-use efficiency under climate change scenarios and accordingly plan for research interventions for developing appropriate strategies for natural disaster mitigation.
- Development of mobile application of web-based expert system on agricultural water management in a farmer friendly manner.
- Sector-wise wastewater reclamation and recycling should be carried out for its productive use.

Institute Research Council (IRC) Meeting

Institute's Research Council (IRC) meeting was organized during May 17-19, 2018 at ICAR-IIWM under Chairmanship of Dr. S.K. Ambast, Director of the institute. Results of the twenty on-going in-house research projects under different programs were presented and deliberated in the meeting. Also, eight new research project proposals were presented and discussed. Dr. S.K. Ambast, Director & Chairman, IRC concluded with remarks and encouraged scientists to continue good work, timely reporting and systematic record keeping. He also emphasized to find out parameters like water use efficiency, water productivity, agricultural productivity, net return and water saving from most of the projects, and publication after completion of each project. Dr. S.K. Jena, Principal Scientist and Member Secretary, IRC organized the meeting.

ICAR-IIWM Organized Biennial Workshop of AICRP-IWM

The Biennial Workshop of All India Coordinated Research Project on Irrigation Water Management (AICRP-IWM) was organized at Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth (DBSKKV), Dapoli, Maharashtra during June 13-15, 2018. Dr. S.K. Chaudhari, ADG (S&WM) graced the inaugural function as Chief-Guest and Dr. S.S. Magar, Ex-Vice Chancellor of the university presided over the session. Dr. Chaudhari expressed the need to extend the developed technologies to the farmers. Dr. Magar emphasized the importance of water for future. Dr. S.K. Ambast, Director, ICAR-IIWM and Project Coordinator, AICRP-IWM, Bhubaneswar, welcomed the dignitaries on and off the dais and briefed about the achievements of AICRP-IWM. Dr. P. Nanda, Principal Scientist, ICAR-IIWM proposed the vote of thanks.

Review Meeting of 'Agri-Consortia Research Platform on Water' Project of ICAR

Dr. K. Alagusundaram, DDG (AE & NRM), ICAR reviewed the progress and achievements of eight major themes under 'Agri-Consortia Research Platform on Water' project during 2017-2018 in presence of Dr. S.K. Chaudhari, ADG (S&WM), NRM and Dr. S. K. Ambast, Director, ICAR-IIWM and LCPC, CRP-W, Bhubaneswar at NRM Division, ICAR, New Delhi on March 23, 2018. The PIs and CCPIs of all the research projects from twenty six different Institutes/ Universities presented their technical and financial progress of the projects during the FY 2017-2018 during meeting. DDG (NRM) expressed his satisfaction on performance of these projects and emphasized the need in improvements in results presentation. Dr. Chaudhari and Dr. Ambast appreciated the work done and data recorded, and stressed on bringing some good publications on the research works conducted at different Institutes and Universities under the projects. Dr. P. Panigrahi, Senior Scientist and Dy LCPC, CRP-W coordinated the review meeting.

EVENTS, NEWS & CELEBRATIONS

ICAR-IIWM Organized *Krishi Jal Prabandhan Mela*

The ICAR-Indian Institute of Water Management organized a 'Krishi Jal Prabandhan Mela' on March 17, 2018, on the occasion of celebrating 'Krishi Unnati Mela'. One thousand and nineteen farmers from different parts of the Odisha state participated in the mela. The gathering was addressed by Hon'ble Prime Minister of India, through live telecast. Padmashree Shri Bhabani Charan Pattanaik, Hon'ble Former Member of Parliament (Rajya Sabha) graced the occasion in presence of Padmashree Dr. A. Parida, Director, Institute of Life Sciences, Bhubaneswar and Shri Priyadarshi Mishra, Hon'ble MLA of Bhubaneswar (North constituency). During mela, farmers were explained about different state of art agricultural water management practices with an objective to enhance their farm income through scientific water management technologies in the field of Rainwater Management, Canal Water management, Groundwater Management and On-farm Technology Dissemination Programme, by visiting pavilion of respective programmes. A farmers–scientist interaction was also organised on this occasion followed by a quiz programme. The winners of the quiz programme were awarded by invited dignitaries and Director, ICAR-IIWM.

Hon'ble Prime Minister Sh. Narendra Modi Ji addressing the farmers during *Krishi Jal Prabandhan Mela*

Hon'ble Prime Minister's Interaction with Farmers

ICAR-IIWM organized an interaction 'Sangosthi' for the farmers and scientists on June 20, 2018, when Hon'ble Prime Minister interacted with farmers from different parts of the country through direct DD Kissan telecast. Twenty three farmers from three villages namely- Jaypurpatna, Jaypur and Bikipur of Khurda district, Odisha were invited to attend this interaction. After this program, farmers interacted with Director and scientists of the institute regarding various problems faced by them pertaining to farming. Also, a field visit for the farmers in the institute's campus was arranged to expose them an efficient irrigation systems like drip and sprinkler along with various intercropping systems.

ICAR-IIWM Played Key-role in *Krishi Kalyan Abhiyan* at Malkangiri, Odisha

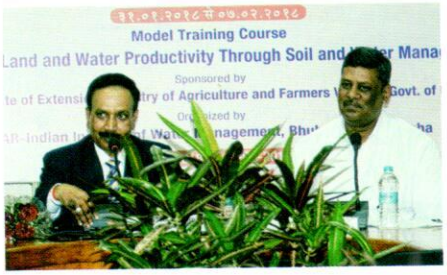
Under 'Krishi Kalyan Abhiyan' of Government of India, four teams of scientists of ICAR-IIWM, Bhubaneswar in collaboration with Krishi Vigyan Kendra (KVK), Malkangiri; State agriculture, horticulture and animal husbandry departments; and village Sarpanch organized four two-days trainings covering 17 villages of Malkangiri district of Odisha. Mini-kits of HYV seeds of pumpkin, okra, ridge gourd, cucumber and Amaranthus were distributed to more than 800 farm families. Scientists of ICAR-IIWM, Bhubaneswar also organized awareness and sensitization campaign on improved agro-techniques, training to the farmers for doubling farm income, 'Kisan Gosthis', cultivation practices of rice and non-rice crop, aquaculture, soil fertility and health awareness, water saving technologies along with drip and sprinkler irrigation etc. KVK staff distributed waste decomposer kits while state agriculture and horticulture department distributed pulse (black gram) / oilseed kits (Sesame), groundnut, green gram seeds and mango planting materials to the farmers, respectively.

Team	Team members from ICAR-IIWM	Villages covered	Number of beneficiary farm families	Duration
Team 1	Drs. S. Roy Chowdhury, S.K. Jena, P.S. Brahmanand and A.K. Nayak	Jharapali, Boilapari, Nilimari, Podaghat and Kumbharput villages	233	June 19-20, 2018
Team 2	Drs. A. Mishra, M. Das, P.K. Panda and P. Debroy	Tandabai, Jaduguda, Bhaluguda and Gangla villages	208	June 21-24, 2018
Team 3	Drs. S. Raychaudhuri, R.K. Mohanty, A.K. Thakur and P. Panigrahi	Jagannath Palli, Himansu Palli, Pangam, Dhungiaput villages	205	June 25-26, 2018
Team 4	Drs. S.K. Rautaray, P. Nanda, H.K. Dash, S. Mohanty and D. Sethi	Chimtapali, Girkanpali, Phulkankonda and Koikunda villages	200	June 28-29, 2018

Krishi Kalyan Abhiyan

Visit of ASRB Chairman at ICAR-IIWM

Dr. A.K. Srivatava, Chairman, ASRB, New Delhi visited ICAR-IIWM on February 3, 2018 and interacted with all staff of the institute.



Republic Day Celebration

ICAR-IIWM celebrated 69th Republic Day of the country on January 26, 2018. On this occasion, National Flag was hoisted by the Director of the institute and he addressed the staff and family members of ICAR-IIWM. He stressed on the need for hard work by the staff for the welfare of farming community and to make the institute as well as the country proud.

ICAR-IIWM Celebrated World Water Day

World Water Day was celebrated at ICAR- Indian Institute of Water Management, Bhubaneswar on March 22, 2018 jointly by ICAR-Indian Institute of Water Management and International Water Management Institute, New Delhi focusing the theme on 'Nature for Water'. Dr. T. Mohapatra, Secretary (DARE) & DG, ICAR graced the occasion as Chief-Guest. Dr. Mohapatra urged upon the stakeholders, who are working in water management sector to take responsibility for rejuvenating the ponds in the state of Odisha, which ultimately can bring diversity in crop production and usher ultimately towards doubling the farmers' income by 2022. Guest of Honour of the occasion, Shri. P.K. Jena, IAS, Principal Secretary, Dept. of Water Resources, Govt. of Odisha highlighted an importance of constructing series of check dams to augment the groundwater resources. Dr. A.K. Sikka, IWMI India representative and Dr. S.K. Chaudhari, ADG (S&WM), NRM Division, New Delhi shared their concerns for rapid decline of groundwater resources in many parts of the country and urged upon for natural way of preserving the water resources for bringing sustainability in crop production. Ten progressive farmers from different parts of Odisha were felicitated for adopting efficient water management technologies developed by the Institute.

Dr. T. Mohapatra, Secretary (DARE) & DG, ICAR releasing ICAR-IIWM publication

Woman farmer felicitated for adopting efficient water management techniques

ICAR-IIWM Celebrated Foundation Day

ICAR- Indian Institute of Water Management celebrated its 31st Foundation Day on May 12, 2018. On the occasion, Dr. V.N. Sharda, Ex-member, Agricultural Scientists Recruitment Board (ASRB) was the Chief Guest of the program. Dr. Sharda delivered the Foundation Day Lecture on 'Challenges of Natural Resource Degradation and Managing Water for Posterity'. Dr. H. Pathak, Director, ICAR-NRRI, Cuttack was the Guest of Honour and the meeting was presided over by Dr. S.K. Ambast, Director of the institute. After the lecture, Institute Proficiency Awards in the administrative, technical and supporting staff categories were given by the Chief Guest. A Brainstorming Workshop was also organized on 'Way Forward for Application of Agricultural Technologies in Aspirational Districts of Odisha'. The program was coordinated by Dr. S. Mohanty, Dr. H.K. Dash and Dr. P. Panigrahi of the institute. In the evening, cultural program was organized for institute's staff and their family members. Dr. M. Raychaudhuri organized this cultural program. Dr. S.K. Ambast, Director ICAR-IIWM felicitated the participants of cultural program.

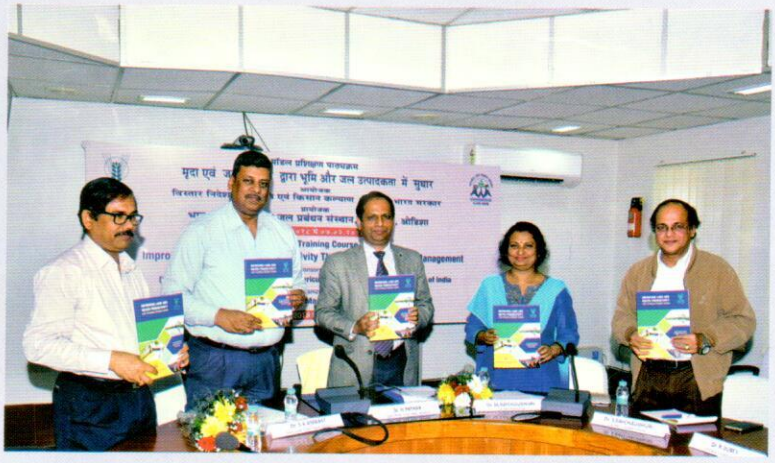
Celebration of International Day of Yoga

The International Day of Yoga was celebrated at ICAR-Indian Institute of Water Management, Bhubaneswar on June 21, 2018. A mass yoga was performed in the morning as per the Common Yoga Protocol (CYP), which was issued by the Ministry of Ayush, Government of India. The yoga practice session ended with a Sankalpa led by Dr. S. K. Ambast, Director, ICAR-IIWM, Bhubaneswar followed by Shantih. A formal workshop on yoga was also conducted in the afternoon and Shri Sudhangshu Sekhar Adhikary, Odisha State Coordinator, Patanjali Yog Peeth, Khurda, Odisha delivered a lecture on 'Usefulness of Yoga in our Day-to-day Life'. Shri Sudhangshu Sekhar, Shri B. Biswal expert from Patanjali and Shri Umakant Sethi, yoga teacher were also present. The program was coordinated by Dr. M. Raychaudhuri, Principal Scientist and Nodal Officer of the International Day of Yoga.

HRD, TRAININGS & CAPACITY BUILDING

ICAR-IIWM Organized Model Training Course (MTC)

A model training course (MTC) on 'Improving Land and Water Productivity through Soil and Water Management' was organized by ICAR-Indian Institute of Water Management during January 3-February 7, 2018. The training program was sponsored by the Directorate of Extension, Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Govt. of India. A total of 22 Officers of Agriculture, Horticulture, Soil Conservation and Water Resources departments from different states participated in this training program. The course compendium entitled 'Improving Land and Water Productivity – A Key to Double Farmers' Income has been released by Dr. H. Pathak, Director, ICAR-NRRI, Cuttack, the Chief Guest of the inaugural program. Dr. M. Raychaudhuri, Principal Scientist was the Course Director and Dr. S. Raychaudhuri, Principal Scientist and Dr. Rachana Dubey, Scientist were Course Coordinators of this training program.



ICAR-IIWM Organized Advanced Capacity Building Program under PMKSY

Advanced capacity building program under 'Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)' was conducted on 'Improving Water Productivity in Rain-fed Agriculture' at ICAR-Indian Institute of Water Management, Bhubaneswar during January 15-19, 2018. The training program was sponsored by Directorate of Soil Conservation and Watershed Development, Government of Odisha under PMKSY. In total, 27 field level officers of the Directorate of Soil Conservation and Watershed Development from 19 districts of Odisha participated in the program. Dr. S.K. Ambast, Director, ICAR-IIWM was the Course Director & Dr. S. Mohanty, Principal Scientist and Dr. P. Panigrahi, Senior Scientist coordinated the training program.

Workshop on 'Water Related Risks - Flood and Drought'

An experience sharing Workshop on 'Water Related Risks - Flood and Drought' was jointly organized by ICAR-Indian Institute of Water Management and International Water Management Institute (IWMI) on May 8, 2018. Dr. K. Alagusundaram, Deputy Director General (Agricultural Engineering & Natural Resource Management), ICAR, New Delhi graced the occasion as Chief Guest. While addressing the gathering, Dr. Alagusundaram appreciated the efforts of the organizers in sensitizing the stakeholders for efficient and timely management of water related risks and stressed the need for index based flood insurance and strengthening the post disaster management by provision of required inputs as and when required. Shri B.J. Sarma, Special Secretary, Dept. of Agriculture & Farmers Empowerment, Govt. of Odisha and Shri S. Singhal, Director, Jharkhand Space Application Centre, Govt. of Jharkhand were the Guests of Honour of the event. Dr. A.K. Sikka, IWMI India Representative explained the importance of collaboration of IWMI with ICAR in tackling flood and drought in India. Dr. Giriraj Amarnath, Research Group Leader, IWMI, Sri Lanka, Dr. K.V. Rao, Principal Scientist, ICAR-CRIDA, Hyderabad and Dr. P.S. Brahmanand, Principal Scientist, ICAR-IIWM, Bhubaneswar presented the outcome of the collaborative research projects on South Asian Drought Monitoring System (SADMS), index based flood insurance (IBFI) and post-flood management in agricultural sector.

Inter-State Farmers Training Program under PMKSY

Two Inter–State Farmers Training Program under 'Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)' was conducted at ICAR-Indian Institute of Water Management, Bhubaneswar for farmers, sponsored by state unit of ATMA.

Detail of programs	Convener / Coordinators	Duration	No. of participants
Doguni kisani aay keliye sinchai jal prabandhan	Dr. S.K. Ambast / Dr. M.K. Sinha, Dr. S. Pradhan & Dr. D. Sethi	January 9-11, 2018	26
Phasal utpadan evum khadya suraksha ke liye krishi jal prabandhan	Dr. S.K. Ambast / Dr. M.K. Sinha, Mr. N. Manikandan & Mr. P. Deb Roy	February 12-16, 2018	22

Participation in Trainings by ICAR-IIWM Staff

Official	Subject	Organization	Period
Mr. P. Deb Roy, Scientist	'Statistical Advances for Agricultural Data Analysis'	ICAR-IASRI, New Delhi	March 3-23, 2018
Dr. S.K. Rautaray, Principal Scientist	'MDP on Leadership Development Program'	ICAR-NAARM, Hyderabad	June 4-5, 2018

Farmers' Training Programs Organized

Subject	Place	Period	Participants
Farmers from Katni Block, Bilaspur (M.P.) on agricultural water management	ICAR-IIWM, Bhubaneswar	February 8, 2018	68
Krishi Jal Prabandhan Mela (under *Krishi Unnati Mela*-2018)	ICAR-IIWM, Bhubaneswar	March 17, 2018	1019
Farmers' training program on 'Acquaintance on adoption of the pressurized irrigation system for increased crop productivity'	Nagpur minor, Balianta, Khurda	March 20, 2018	53

Exhibitions

Institute's achievements were displayed/ showcased in the following exhibitions held at different locations:

Events	Place	Date / Period
Exhibition by OSEE	ICAR-CIWA, Bhubaneswar	February 1-3, 2018
State-level Exhibition	Barmunda, Bhubaneswar	March 6-9, 2018
Krishi Jal Prabandhan Mela-2018	ICAR-IIWM, Bhubaneswar	March 17, 2018
Exhibition during Foundation Day	ICAR-NRRI, Cuttack	April 23, 2018

Swachh Bharat Abhiyan

The Director and staff of ICAR-IIWM, Bhubaneswar participated actively in 'Swachh Bharat Abhiyan' and 10 numbers of cleanliness campaigns were conducted during January to June, 2018 in the Institute's main campus and public places. Under Digital India campaign, ICAR-ERP system of all the staff of the Institute was updated and Government e-Market (GeM) is being utilized for e-procurement. An awareness talk and presentation of short film on 'Importance of compost making from kitchen waste under 'Swachh Bharat Abhiyan' was organized to the farmer trainees of Bihar under PMKSY training held in January 2018. Insecticides (mosquito repellents) were sprayed in water bodies and premises of main campus to prevent spread of dengue and other human diseases. Pruning of shrubs and beautification was performed at front and rear sides of the main building. Plantation of horticultural saplings was done in the main campus on June 29, 2018. Special awareness campaigns were organized on eradication of Parthenium weed in MGMG villages of Garadpur block of Kendrapara district, Odisha. Some staff of ICAR-IIWM participated in Swachhata activities at Pipli, Puri district and Dangmal, Kedrapara district of Odisha.

Awareness campaigns on eradication of *Parthenium* weed

Mera Gaon - Mera Gaurav

Training and interaction meeting organized at adopted villages

Details of program	Place and Date	No. of beneficiary farmers
Farmer-Scientist interaction on integrated farming system and water management in *rabi* and summer crops	Bindhapada village, Tirtol block January 20, 2018	10
Awareness about the insects pest and diseases in groundnut crop	Bhakarsahi village January 27, 2018	26
Scientists-farmers interaction on problems in *rabi* crop (green gram)	Madana, Jagannathpur, Patkura, Chandapalla and Naindipur villages of Kendrapara district January 27, 2018	12
Farmer's-Scientist's interaction on salinity of groundwater in waterlogged areas	Sukal village, Puri February 4, 2018	21
Farmers' interaction meet on integrated farming system, soil management, fish culture, water management in *rabi* and summer crops	Hasimnagar village March 3, 2018	15
Farmer-Scientist interaction on water management in summer crops	Durgapur, Giringaput, Haridamada villages March 5, 2018	05
Farmers meeting on improving the productivity of *rabi* mung bean and field visit on pest identification	Sarat and Bhakarsahi villages March 14, 2018	31
Awareness program on water management practices and pests / diseases control in pulses and vegetables (brinjal)	Jagannathpur village of Kendrapara district March 23, 2018	11
Training program on package of practices of summer crops like green gram, okra, watermelon, bitter gourd, brinjal, pointed gourd, ridge gourd etc.	Patkura, Chandapalla and Naindipur villages of Kendrapara district April 28, 2018	10
Discussion on *Paramparagat Krishi*	Balipatna Block May 26, 2018	23
Awareness training program involving NGO on improved water management strategies for *kharif* season crop and optimal cropping pattern	Madana village of Kendrapara district May 30, 2018	12
Awareness on insect pests, diseases and weeds of pumpkin crop	Bhakarsahi village June 23, 2018	21

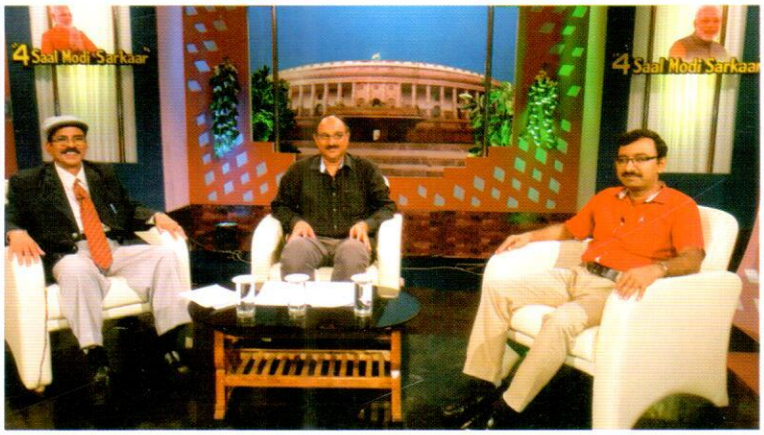
Scientist-farmers interaction on *rabi* crop cultivation at Jagannathpur

Interaction with farmers regarding brinjal cultivation at Jagannathpur

AWARDS, HONOURS & RECOGNITIONS

- Drs. P.K. Panda, R.K. Mohanty, P. Panigrahi and A. Kumar received 'Best Poster Award' at 3rd ARRW International Symposium held at ICAR-NRRI, Cuttack during February, 6-9, 2018 for the paper entitled 'Development of Runoff Recycling Model for Climate Resilience and Profit Enhancement of Rainfed Rice'.
- Dr. Rachana Dubey, Scientist has received DST project entitled 'Optimizing Soil Organic Carbon Stock in Rice Based Cropping System under Irrigated Ecosystem' under 'Early Career Research Award' by the Science and Engineering Research Board (SERB).
- Dr. M. Raychaudhuri, Principal Scientist appointed as recorder for the section-'Agriculture and Forestry Sciences' for 2018-2020 by Indian Science Congress Association; Chaired technical session in workshop on 'Advances in Environmental protection and Sustainability' held at IIT, Guwahati on June 2, 2018.
- Drs. M. Raychaudhuri and S. Raychaudhuri, Principal Scientists have been invited to deliver talk in 'National Conference on Organic Waste Management for Environmental and Food Security' jointly organized by ICAR-IISS & Indian Society of Soil Science (Bhopal chapter) during February 8-10, 2018.
- Dr. M. Raychaudhuri, Principal Scientist acted as co-chairperson in 'National Conference on Organic Waste Management for Environmental and Food Security' on February 9, 2018 organized jointly by ICAR-IISS & Indian Society of Soil Science (Bhopal chapter).
- Dr. P.S. Brahmanand, Principal Scientist has been elected as Executive Member of Indian Society of Water Management (Odisha Chapter) for the period of 2018-2020.
- Dr. S. Raychaudhuri, Principal Scientist delivered keynote address in the 'World Water Summit 2018' held on March 22, 2018 at New Delhi.

DD Kisan/ Radio Talk



- Dr. P. K. Panda participated in group discussion on 'Jala Sangrakhyan O Ahara Parichalanara Abasyakata' (Importance of Water Conservation and Its Management) in Vigyan Prasar program, telecasted on February 15, 2018 on Doordarshan.
- Dr. P. K. Panda participated as an expert in discussion program on 'Water Security and Role of Society', telecasted on March 20, 2018 on Doordarshan on the occasion of World Water Day.
- Dr. P. Nanda and Dr. P.K. Panda participated as an experts in the panel discussion on 'Pradhan Mantri Krishi Sinchai Yojana and its implications', telecasted on June 8, 2018 on Doordarshan.
- Dr. P. K. Panda delivered a radio talk on 'Ana-dhana Rabi Fasalare Jala Niyantrana' (Water Management in Non-paddy Rabi Crops) on January 18, 2018, and participated as an expert to discuss on the topic 'Strategies for Doubling Farm Income' on All India Radio, Cuttack on June 10, 2018.

Deputation Abroad

Dr. P.S. Brahmanand, Principal Scientist & PI of IBFI project visited University of Georgia, USA during May 14-19, 2018 on deputation to participate an International Training Program on DSSAT-4.7 Version with a theme 'Assessing Crop Production, Nutrient Management, Climatic Risk and Environmental Sustainability with Simulation Models'.

Promotion

Mr. Nilakantha Mallick, UDC (Level 4) promoted to UDC (Level 5) and Mr. Bhaskar Dutta, SSS (Level 2) promoted to SSS (Level 3) under Modified Assured Career Progression (MACP) scheme w.e.f. November 26, 2016 and April 07, 2018, respectively.

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