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## Visit of Hon'ble Union Minister of Agriculture and Farmers' Welfare



Hon'ble Union Minister of Agriculture and Farmers Welfare, Shri Radha Mohan Singh visited ICAR-Indian Institute of Water Management, Bhubaneswar on September 2, 2016 for an interaction meeting with officials of Odisha State Department, Odisha University of Agriculture and Technology, all ICAR Institutes/ Regional Research Stations and KVKs to discuss the progress of work done in different sectors of agriculture and associated farmers' welfare. In his address Hon'ble Minister emphasized upon synergy between State Agricultural University, ICAR institutes and State Departments for increased pace of agricultural development in the eastern region. He also urged upon the need for gender neutrality in research organizations as well as promotion of farm women friendly technologies; need for capacity building programmes in agriculture and allied sectors viz., horticulture, fisheries and animal husbandry for overall improvement of farm productivity and income. Shri Chhabilendra Roul, Additional Secretary, DARE & Secretary, ICAR welcomed the Union Minister and guests, Dr. S.K. Ambast, Director, ICAR-IIWM apprised the activities of the Institute.

## Water and Energy Efficient Integrated Farming System (IFS) for Rainfed Farmers

The food and agriculture sector depends heavily on water and energy resources, globally using 70% of water withdrawals and 30% of end-energy. In India, in spite of large-scale expansion of irrigation system, about 55% of the net cropped area is under rainfed. The income of small and marginal farmers from seasonal field crops is not sufficient to sustain their livelihood. Erratic rainfall under climate change scenario further accentuates the problem. Multiple use management of harvested water and adoption of water-use efficient cropping system is useful in water scarce situations. Thus, integrated farming system (IFS) is an important management option for small and marginal farmers of rainfed agro-ecosystem to generate more food, employment and income per unit area.

The study carried out at ICAR-IIWM research farm revealed that water and energy efficient farming system could be achieved through alternate cropping system viz. rice-horse gram and rice-sunflower with greater reliance on green manure and vermi-compost, and less use of agro-chemicals. The farming system model area (3408.44 m<sup>2</sup>) consisted of water harvesting pond (900 m<sup>2</sup> water spread area x 2.8 m depth), pond embankment area (556 m<sup>2</sup>), field crop unit area (1879 m<sup>2</sup>) and field bund area (73.44 m<sup>2</sup>). The pond embankment was used for cultivation of papaya, banana, mushroom and poultry & honey rearing. Water from the farm pond was used for fish and duck rearing and providing supplemental irrigation to crops. The techniques which were followed: mulching, ring method of irrigation to cucurbits, paired-row bed planting for okra, multiple use of water for pisciculture, horticulture, apiculture, poultry and mushroom cultivation, growing of widely spaced crops with large canopy coverage with bottle gourd and water melon, red gram cultivation on field bunds. Use of droppings from poultry and duckery to fish culture, paddy straw for mushroom cultivation, and bio-waste for vermi-compost production saved energy on fish feed and fertilizer.

Growing of paddy crop during rainy season under integrated nutrient managed with in-situ green manuring (*Sesbania rostrata*) resulted in higher energy output: input ratio (18.7) and net returns (₹ 27,982/ha) as compared to use of chemical fertilizers alone (energy output: input ratio of 13.9 and net return of ₹ 23,412/ha) considering the base year for calculation as 2011. After the harvest of paddy, growing of horse gram under reduced tillage, and use of farm generated vermi-compost reduced energy requirement and resulted in high energy output: input

ratio, water productivity, net returns and beneficial residual soil fertility. Overall, net return and employment generation was ₹ 1,88,341/ha and 509/ha, respectively under IFS as compared to only rainy season rice (₹ 27,982/ha and 158/ha). Net water productivity was computed as ₹ 54/m<sup>3</sup> due to multiple use of water. Using this technology, low productivity in rainfed areas can be enhanced and surplus labour of small and marginal farming families can be gainfully employed. The system of waste recycling and inclusion of green manure is very useful when the profit margin in agriculture is low due to steep rise in fertilizer cost after withdrawal of subsidy.



S.K. Rautaray, A. Mishra, R.K. Mohanty and M.S. Behera

## An Innovative Technological Option for Increasing Freshwater Availability in Coastal Saline Areas

Coastal tracts face double whammy problems due to water congestion during monsoon season and non-availability of fresh water during post-monsoon period. Further, ingress of saline water and mixing with existing water resources aggravates the situation and it is a menace and a challenge to the farmers for agriculture, aquaculture and allied activities in the area. Hence, concerted efforts were made to develop appropriate technological option for utilizing water resources from existing natural creeks and water bodies for irrigation to crops during post-monsoon season; thereby increasing land and water productivity, under Sunity Gram Panchayat in Odisha. The Panchayat is consisted of 23 villages located within 15 km away from the coast line in Mahakalpada block of Kendrapara district. Total geographical area is ~3900 ha, out of which cropped area is ~1322 ha only. During *kharif* season, main crops viz. paddy and vegetables are grown in 1200 ha and 122 ha, respectively; however, due to lack of freshwater for

irrigation, about 57 and 85% of the cropped area remain fallow during *rabi* and summer season, respectively. Natural creeks and 65 number of water bodies are located in the area as source of irrigation; but saline water enters through the creeks and freshwater gets salinized during high tides. EC of the water varies from 6 to 27 dS/m from the month of March upto monsoon season.



In order to check the saline water entry through creeks, hydrologic and hydraulic study was performed to identify the exact location for construction of sluice structure. Then a sluice gate structure, as shown in the photograph, was designed and constructed in the mouth of Sunity creek in collaboration with Department of Water Resources, Govt of Odisha. This has helped to check the ingress of saline water through creeks and also drain the flood water during monsoon season. After operation of the sluice gate structure, saline ingress was checked, EC of water do not exceed 2 dS/m even during summer season. To store the

excess rainfall during monsoon season, potential storage capacity of existing water harvesting structures were worked out and found that its depth could be increased up to 2.5 m, which will also check the upconing of saline water. Best hydraulic design of creeks sections were proposed to carry upto 25 m<sup>3</sup>/s of water. Due to availability of water in creeks and water harvesting structures, there was 27 and 37% increase in *rabi* and summer cropped area, respectively. It also ensured freshwater availability throughout the year and resulted in enhancement of crop productivity by 36 and 26% in *rabi* and summer season, respectively.

*Ranu Rani Sethi, R.C. Srivastava, Madhumita Das, P.S. Brahmanand, J.K. Tripathy and S.K. Ambast*

## Hon'ble Secretary, DARE and Director General, ICAR, Dr. Trilochan Mohapatra Visited ICAR-IIWM

Hon'ble Secretary, DARE and Director General, ICAR, Dr. T. Mohapatra visited the Institute on October 1, 2016, and discussed on the ongoing research programmes and interacted with scientists. In his address, he stressed upon the need of replicating cutting edge technologies in the field of agricultural water management, technology dissemination and upscaling of proven technologies on rainwater conservation and its recycling, equity in canal water distribution, waste water utilization and management of waterlogged areas. He also emphasized on the importance of water and social science sector for charting policy guidelines which has the scope to find a place in high impact factor journals.



Further, on the eve of commemorating Gandhi Jayanti on October 2, he administered pledge on 'Swachhata Abhiyan' programme to all staff members of the Institute and called on swachhata in a holistic manner so that it really fulfills its objective of taking the nation to a newer height. He also took part in making a 'Human Chain' to inspire all participants. Later, as Chief Guest, Hon'ble Secretary, DARE & DG, ICAR, graced the valedictory function of a training program on 'Water management strategies in watershed development under PMKSY' that was organized for PIAs of Directorate of Soil Conservation and Watershed Development, Govt. of Odisha.



## Advanced Capacity Building Program under PMKSY

Advanced capacity building programme for Project Implementing Agencies (PIAs) of Directorate of Soil Conservation and Watershed Development, Govt. of Odisha was conducted in six phases (August 22-25, September 6-9, September 28-October 1, October 3-6, October 17-20 and November 2-5, 2016) under *Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)* at ICAR-Indian Institute of Water Management, Bhubaneswar.



The four-day training programmes were aimed at developing water management strategies in watersheds for increasing acreage under irrigation and enhancing water use efficiency. In addition to the resource person from the Institute invited talks were arranged from experts of ICAR-Indian Institute of Soil & Water Conservation, Dehradun; ICAR-Central Horticultural Experiment Station, OUAT, Directorate of Soil Conservation & Watershed Development, Govt. of Odisha and Odisha Space Application Center, Bhubaneswar. Course contents comprised of basic surface hydrology to all subject areas in advance application of integrated watershed management with specific reference to PMKSY: hydro logic, hydraulic design of various water harvesting structures micro-irrigation system; remote sensing aided watershed mapping and characterization; horticultural and aquacultural interventions; and economic evaluation of watershed management programmes. A field visit was arranged to Biswanahakani watershed, Cuttack, which is a saturated model watershed, for field exposure to the PIAs. The programme was attended by 120 PIAs from all 30 districts of Odisha. These programmes were coordinated by Drs. R.K. Panda, S.K. Jena, R.R. Sethi, P. Nanda, S. Mohanty and P. Panigrahi along with Dr. S.K. Ambast, Director of the institute.



## District Irrigation Plan (DIP) under PMKSY

ICAR-Indian Institute of Water Management involved in preparing the District Irrigation Plans for Cuttack, Jagatsinghpur, Nayagarh, Kendrapada and Sundergarh districts of Odisha, submitted to Directorate of Soil Conservation & Watershed Development, Govt. of Odisha, a nodal agency for developing State Irrigation Plan of Odisha.

## Chief Scientists' Meet at Gwalior

Chief Scientists' Meet of the AICRP on Irrigation Water Management was jointly organized by ICAR-Indian Institute of Water Management, Bhubaneswar and Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya (RVSKVV), Gwalior during August 19-22, 2016. Shri Narendra Singh Tomar, Hon'ble Minister of Rural Development, Panchayati Raj, Drinking Water and Sanitation, Govt. of India was the Chief Guest on the Foundation Day Celebration of RVSKVV and inaugural function of Chief Scientists' Meet. He addressed the gathering, and mentioned the challenges to retain farmers in villages due to decreasing profit in agriculture. He also emphasized on the importance of water for efficient use in agriculture by growing more crop per drop of water and cautioned that the water table and quality is decreasing day-by-day and steps should be taken to save water through use of micro-irrigation. Smt. Maya Singh, Hon'ble Minister for Urban Development and Housing, Madhya Pradesh stressed on more research on safer use of domestic and industrial sewage water in agriculture. Other dignitaries present in this occasion were: Dr. N.S. Rathore, DDG (Education), ICAR; Prof. A.K. Singh, Hon'ble, Vice-Chancellor, RVSKVV; Shri Lakhan Singh Yadav, Hon'ble MLA; Dr. A.K. Sikka, In-Charge India Programme, IWMI; Dr. S.K. Chaudhari, ADG (S & WM), ICAR; Dr. S.K. Ambast, Director, ICAR-IIWM and Dr. J.P. Dixit, Dean, College of Agriculture, RVSKVV, Gwalior. Dr. P. Nanda and Dr. M. Raychaudhuri, Principal Scientists, IIWM coordinated the meet.



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

Dr. S.K. Chaudhari, ADG (S&WM), NRM Division, ICAR and Dr. S.K. Ambast, Director, ICAR-Indian Institute of Water Management, Bhubaneswar reviewed the progress and achievements of eight major research themes under on-going 'Agri-Consortia Research Platform on Water' project of ICAR on November 7, 2016 at the Institute. The PIs and CCPIs of all the research themes/ projects from twenty five different Institutes/ Universities presented their technical and financial progress of the first six months of FY 2016-2017 in the meeting.



## Brain Storming Meeting of NAAS



Brain Storming Meeting on 'Minimizing water use in agriculture' was organized at ICAR-IIWM on September 3, 2016. Dr. Khageswar Pradhan, Ex-VC, OUAT, Bhubaneswar was the Chief Guest of the function and presidential address was given by Dr. D.P. Ray, Ex-VC, OUAT, Bhubaneswar. Four technical sessions in the meeting were: minimizing water use in agriculture and horticulture, agricultural water management in the context of climate change, water governance and policy, and minimizing water use in livestock and fisheries, followed by a panel discussion. Dr. A.K. Singh, former DDG (NRM), ICAR, New Delhi and Vice-Chancellor, Rajmata Vijayaraje Scindia Krishi Vishwavidyalaya, Gwalior chaired valedictory session of the meeting and emphasized on to harvest excess runoff water to combat erratic rainfall; urged to take challenges of utilizing wastewater or marginal quality water for aquaculture. Dr. G. Kar, Principal Scientist of the institute coordinated the meet.

## Hindi Pakhwada Celebrated



ICAR-IIWM celebrated Hindi Pakhwada during September 14-28, 2016. During this pakhwada, various Hindi (Rajbhasha) competitions were organized viz. Hindi-English translation, essay writing, Hindi speech, Hindi debate, Hindi chitralakhan and official note writing in Hindi etc. Dr. O.P. Verma, Scientist of the institute coordinated the pakhwada.

## Farmer-Scientists Interaction-cum-Awareness Program



A farmer-scientists interaction-cum-awareness program on 'Safe use of wastewater in agriculture' was organized by ICAR-Indian Institute of Water Management on September 16, 2016 at the Agriculture Block Office, Banarpal, Angul, Odisha. Sixty farmers including twenty seven women farmers from surrounding villages participated in this program. A group of scientists of the Institute and officials of Department of Agriculture, Govt. of Odisha shared their experiences and discussed on problems usually occurring in agriculture due to wastewater use. Dr. Rachana Dubey, Scientist of the institute coordinated this program, and attended by Dr. A. Mishra and other scientists of the institute.

## ICAR-IIWM Celebrated Vigilance Awareness Week

Vigilance Awareness Week was celebrated by the Institute during October 31 to November 5, 2016. Dr. S.K. Ambast, Director, inaugurated the week-long programme and administered the pledges to all staff members. In this occasion, a lecture was delivered by Shri N.V.R.N. Murty, F&AO of the Institute on 'Probity in handling public finance to eradicate corruption' on November 2, 2016.



During the week, two debate competitions were also organized for the students of Utkal Gourav High School, Delang, Puri district on November 2, 2016 and Naindipur U.P. School, Naindipur, Kendrapara on November 4, 2016 on the topic 'Public participation in promoting integrity and eradicating corruption'. Dr. S. Roy Chowdhury, Principal Scientist of the institute coordinated the program.



## IGNOU Program on Watershed Management

ICAR-IIWM, Bhubaneswar initiated IGNOU program for 'Diploma course on watershed management' for the session 2016-2017. Counseling classes for both theory and practice paper has been started from November 6, 2016 at the Institute. Dr. R.R. Sethi, Senior Scientist of the institute is coordinator of the program.



## Farmer's Training under Tribal Sub-Plan Project

Two 2-days farmers' trainings were conducted, first on July 26-27 with 108 farmers at Mahuljore village and second on December 8-9, 2016 with 64 farmers at Birjaberna village of Sundergarh district, Odisha. Farmers were trained on water management techniques, water saving methods for enhancing crop productivity. Dr. R.K. Panda, Principal Scientist of the institute coordinated the training program.



## Camps for Staff Welfare at ICAR-IIWM



Sports and Staff Welfare Committee of ICAR-IIWM organized free dental and eye testing camps on August 6 and 12, 2016, respectively for the staff and their family members.

## Krishi Siksha Diwas and World Soil Day



On the occasion of *Krishi Siksha Diwas* on December 3, 2016, ICAR-IIWM technologies were exhibited for the students of different schools of Bihar at Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar. On the occasion of World Soil Day on December 5, 2016, Dr. Mausumi Raychaudhuri addressed the farmers of Bihar on 'Resources management in agriculture' at Dr. RPCAU, Pusa, Bihar.

## Exhibitions

To showcase and disseminate water management technologies developed by the Institute, ICAR-IIWM participated during the 4<sup>th</sup> International Agronomy Congress organized by the Indian Society of Agronomy during November 22-26, 2016 at IARI, New Delhi.



ICAR-IIWM participated in *Kisan Mela* organised by Dr. Rajendra Prasad Central Agricultural University, Samastipur, Bihar and exhibited the ICAR-IIWM technologies for the visitors during December 3-5, 2016.



## Swachha Bharat Abhiyan

The Director and staff of the Institute actively participated in *Swachha Bharat Abhiyan* and eight number of cleanliness campaigns were conducted between July to December in the main campus of the Institute. A lecture on 'Swachha Bharat Abhiyan with special emphasis on control of obnoxious weed *Parthenium hysterophorus* (carrot grass)' was organized and cleanliness drive for eradication of this weed outside the main campus of the Institute was undertaken during 'Parthenium Awareness Week' (August 16-22, 2016). As a part of fortnightly *Swachhata Pakhwada* celebrations during October 16-31, 2016 under the directives of Government of India and ICAR, Dr. S.K. Ambast, Director, administered the *Swachhata Shapath* to all the officers and staff of the Institute. An awareness campaign on *Swachha Bharat Abhiyan* and *Parthenium* eradication was organized in Chandpalla village, Kendrapara district, Odisha and a talk on importance of cleanliness and weed eradication was organized for the trainees from Directorate of Soil and Water Conservation and Watershed Development under PMKSY at ICAR-IIWM on October 20, 2016. Dr. P.S. Brahmanand, Principal Scientist of the institute coordinated these programs.



A cleanliness programme under *Swachha Bharat Abhiyan* was organized at Bindhapada village, Tirtol block, Jagatsinghpur district, Odisha on October 29, 2016.



## Mera Gaon - Mera Gaurav

- One training program was organized at Jamujhari village of Jatni block, Khodha district on November 11, 2016 on integrated pest management approaches for *rabi* rice and pulses.



- Scientists of ICAR-IIWM organized interaction meet and demonstration on mushroom cultivation with farm women on November 19, 2016 at Hasimnagar village, Tirtol Block, Jagatsinghpur district, Odisha.
- Three training programmes were conducted under *Mera Gaon Mera Gaurav* program at the villages in the Balipatna block. First program was conducted at Poijhari village on August 6, 2016 on fish culture, agricultural marketing and water harvesting. Forty farmers attended this program. Second training was conducted in collaboration with IFFCO on September 17, 2016 at Bhakarasahi village for the forty farmers on preparation of soil health card and government schemes in agriculture and horticulture. Last farmers'-scientist interaction meet cum training program was organised at Sarata village on October 29, 2016 on agricultural water management and government schemes in agriculture. Thirty farmers participated in the program and thereafter, *Swachha Bharat* drive was also organised after the training program.



- Technical guidance to the farmers of five villages i.e., Madana, Jagannathpur, Patakura, Garadpur and Naindipur of Kendrapara district of Odisha were provided on improved methods of water management for the rice crop and vegetables during *kharif* season. Also, farmers were trained regarding the water management practices and integrated pest and disease management measures for the *rabi* crops including pulse.



## Rubber Dams Installed in 8 States

ICAR-IIWM, Bhubaneswar has successfully installed rubber dams in different agro-ecological regions of the country spreading in 8 states (Odisha, Uttarakhand, Himachal Pradesh, Tamil Nadu, Gujarat, Maharashtra, Meghalaya and West Bengal).



## Awards / Honours / Recognitions

- Dr. S.K. Ambast, Director, ICAR-IIWM and associates received 'Dr. Rajendra Prasad Puruskar for Technical Books in Hindi in Agricultural and Allied Sciences, 2015' in the category of Natural Resource Management and Agricultural Engineering.



- Dr. S.K. Jena, Principal Scientist and his team received 'ICAR Award for Outstanding Interdisciplinary Team Research in Agricultural and Allied Sciences 2013-14' in the category of Natural Resource Management and Agricultural Engineering for their research work on design, development and application of rubber dam in watersheds for enhancing agricultural productivity.



- Dr. K.G. Mandal, Principal Scientist, has been admitted as Fellow of the Indian Society of Agronomy (ISA), New Delhi for the year 2013 in recognition of his outstanding contributions to Agronomy. He received this recognition during 4<sup>th</sup> International Agronomy Congress held at IARI, New Delhi on November 22-26, 2016.



- Dr. K.G. Mandal, Principal Scientist, has been elected Fellow of the West Bengal Academy of Science and Technology (WAST), Kolkata in the year 2016 for his notable contributions in the field of Agronomy (Section: Agriculture & Forestry). He received the fellowship citation during 26<sup>th</sup> Annual General Meeting of the academy held at IICB, Kolkata on December 22, 2016.



- Dr. P.S. Brahmanand, Principal Scientist has created a new Guinness World Record in the category of 'Fastest time to identify all elements of the periodic table' by identifying 118 elements from Hydrogen to Ununoctium in 3 min. 54.06 sec.

- Dr. P. S. Brahmanand, Principal Scientist has been presented with 'Outstanding Scientist Award' during 4<sup>th</sup> International Conference on Recent Advances in Agriculture and Horticulture Sciences held at Jodhpur during December 30-31, 2016.



- Dr. S. Roy Chowdhury, Principal Scientist and co-authors has been awarded 'Best paper presentation' award for their research paper entitled 'Response of over-aged seedlings under different N level for yield, N utilization pattern and dry matter partitioning efficiency of rice under waterlogged condition' during 4<sup>th</sup> International Conference on Recent Advances in Agriculture and Horticulture Sciences held at Jodhpur during December 30-31, 2016.



- Dr. P.K. Panda, Principal Scientist and co-authors received 'Best Poster Award' at 4<sup>th</sup> International Agronomy Congress held at IARI, New Delhi during November 22-26, 2016 for the paper entitled 'Runoff harvesting and recycling for production and profit enhancement through land modification and crop management practices'.

- Dr. Rachana Dubey, Scientist obtained Ph.D. degree in Environmental Sciences from ICAR-Indian Agricultural Research Institute, New Delhi. Her topic of research was 'Adaptation options for alleviating terminal heat stress in wheat'.

## Radio and TV Talks

Dr. P. K. Panda, Principal Scientist of the institute delivered a radio talk on '*Kharif Dhana Phasalare Jala Parichalana* (Water management in *kharif* rice)' in *Krusha Sansar* program organized by All India Radio Cuttack Centre on July 27, 2016. He also delivered a television talk on '*Jala Amala Prakalpa Dwara Gramanchalare Jibika Manara Unnati* (Watershed management for livelihood improvement in rural areas)' in *Pallishree* program organized by Doordarshan Kendra, Bhubaneswar on October 4, 2016.

## Joining/ Transfer/ Superannuation

- Mr. Abhijit Sarkar, Scientist (Soil Science) joined ICAR on July 5, 2016 (FN) and this institute on October 15, 2016 (FN)
- Mr. Vinod Kumar Sahoo, Finance & Accounts Officer (F & AO) joined ICAR on August 1, 2016 (FN) and this institute on November 18, 2016 (FN)
- Shri N.V.R.N. Murty, F & AO of the institute relieved from his additional duty on November 17, 2016



## Water Management in Pulses: A Necessity for Food and Nutritional Security


Pulses are highly nutritious and beneficial to health. These crops have ability to mitigate and adaptive capacity to climate change. Because of legume-*rhizobium* symbiotic association, it promotes biodiversity in the ecosystem. Pulses have a low water footprint, making them appropriate choice to fit into rice-fallows and even to regions prone to drought. It promotes food security. In 2016, we celebrated the *International Year of Pulses (IYP)* with the aim to raise the awareness of these highly beneficial crops and augmenting their production and consumption around the world. In India, pulses are grown in about 24-26 million ha with an annual production of 17-19 million tonnes. However, it has recorded less than 1% annual growth during the past 40 years. Consequently, per capita production and availability has witnessed a sharp decline.

India accounts for 79% (11.65 million ha) of the total rice-fallows of south Asia (~15 million ha), mainly spread over the states of Andhra Pradesh, Assam, Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Odisha, West Bengal and Uttar Pradesh. For augmenting pulses production, these rice-fallow areas offer a huge potential niche for growing of short season pulses in the country. One of the major constraints to pulses production is lack of irrigation. More than 87% of the area under pulses is rainfed and are primarily grown on residual soil moisture. Terminal drought and heat stress results in forced maturity and low yield, whereas a quantum jump in production and yield can be achieved by applying supplemental irrigation especially in *rabi* pulses grown on residual soil moisture.

Though water requirement for pulse crops is less, development and adoption of existing water management technologies are the necessity

for rice-fallow areas and increasing pulses production. Both productivity and water use efficiency in pulses can be enhanced through soil moisture conservation techniques. These include retention of crop residues in the field, direct drilling of seeds using no-till seed drill, effective utilization of residual soil moisture by *paira* cropping and mulching. Experiments conducted in different agro-ecological regions of the country under All India Coordinated Research Project on Irrigation Water Management clearly suggests that providing 1-2 supplemental irrigation can nearly double the yield of most of the pulse crops. Micro-irrigation especially sprinkler irrigation holds promise for increasing pulses production with less water. On the other hand, excess moisture is harmful for the pulses due to anoxic condition in rhizosphere; in those situation, broad-bed and furrow method may be adopted, which facilitates drainage of excess water.

There is a need for augmenting water resources at farmers' field. Development of on-farm water storage structures in rainfed areas, and auxiliary tanks and dug-wells in canal commands especially in tail-ends, facilitate harvesting of rainwater and storage of excess canal water delivered during rainy season. The augmented water resources would provide at least one irrigation to pulses and other crops through conjunctive use of water and short-duration fish culture in constructed ponds. Even though the IYP has come to an end, there is still much more to be done to accomplish both food and nutritional security.

  
(S. K. Ambast)

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