



CSWCRTI News



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From the Director's Desk..



The recent disaster in Uttarakhand in June 2013 due to rainfall extremes has left all of us in a state of great shock. Such a climate surprise (rain on snow), though not uncertain, but uncommon in such magnitude and appearance, caused huge loss of life and property, a damage that is beyond anybody's comprehension. This episode has triggered the government and other field functionaries to seriously think of an effective disaster response and management system, since

rehabilitation and restoration is a time consuming process.

The Indian Council of Agricultural Research (ICAR) has risen to this occasion and has taken a proactive step in analyzing the disastrous situation that affected the agriculture and allied sectors in the State. Relief poured in from various Institutes of ICAR. All the staff of CSWCRTI and its Research Centres contributed one day's salary for rehabilitation of the disaster victims. A two days workshop was conducted on August 1-2, 2013 at CSWCRTI, Dehradun with participation of all the stake holders of NARS system and the State officials under the leadership of Dr. S. Ayyappan, Secretary, DARE and Director-General, ICAR to draft an action plan for agriculture sector in the State. A Joint Action Group was constituted consisting of representatives from ICAR Institutes/Stations; Director, CSWCRTI, Dehradun; Director, VPKAS, Almora; and Director (Agriculture), Government of Uttarakhand as members of the Action Group. Director, CSWCRTI and Director (Agriculture), Uttarakhand shall work as Nodal Officers from NARS and Uttarakhand Govt., respectively. Director, CSWCRTI, Dehradun shall be the leader of the team while Garhwal and Kumaon regions will be looked after by Director, CSWCRTI and Director, VPKAS, respectively.

Agriculture in the hill states depends upon the health of natural resources which are fragile and sensitive to climate change. The action points on NRM relating to soil and water conservation in form of advisories to state were circulated amongst the stake holders. The short term measures recommended for immediate action are cleaning of drainage lines, desilting of irrigation channels, reconstruction of damaged terrace with provision of shoulder bunds reinforced with vegetative barriers, levelling of agricultural fields (wherever required), removal of excess water from currently planted fields, application of spilt dose of nitrogen after weed removal, and grass seeding and plantation on exposed surfaces of eroded lands along with mechanical measures. The long term measures needing action are protection of stream bed with bio-engineering measures and plantations (gabion spurs, embankments, revetments, silvipasture etc.); promotion of hand operated farm tools/implements, animal power implements and minimum tillage; general awareness creation and capacity building on various aspects of natural resource conservation and climate change awareness; construction of a series of small check dams in lower order streams for runoff harvesting and sediment control; formulation of Task Force at Panchayat level for cleaning of drainage channels before monsoon; preparation of Landslide Susceptibility Atlas; and afforestation of barren lands with trenching. Besides, a media meet showcasing soil and water conservation technologies in the disaster perspective was conducted at CSWCRTI, Dehradun on 30th August in collaboration with GBPUAT, Pantnagar and NAIP, ICAR.

The last semester has shown many promises in conducting various R&D programmes focusing on the commitment of our staff to the cause of conservation and environment.

P.K. Mishra

New Initiatives

(i) Projects Launched under Tribal Sub Plan

New projects for sustainable development of tribal farmers of Udpalta and Attal villages (Dehradun, Uttarakhand), Challanput, Patraput and Mukhibidei villages (Koraput, Odisha) and Thirichigadi village (Nilgiri, Tamil Nadu) have been initiated under Tribal Sub Plan (TSP) by CSWCRTI. At Udpalta, Dr. P.K. Mishra, Director inaugurated a Animal Health Camp on 6th September, 2013. He stressed on sustainable utilization of resources for sustainable development and livelihood security. Forestry Day and Horticulture Day were also organized in the village. Various developmental activities pertaining to soil and water conservation have been initiated under the project. Plantations of multipurpose trees on degraded lands and pomegranate on arable land have been undertaken. On landslide affected area, 400 sq.m geo textile has been laid. In villages of Semiliguda, project was inaugurated by Shri Ramachandra Kadam, Hon'ble MLA, Pottangi on 8th August, 2013. He appreciated initiation of work for natural resource conservation by the Research Centre in remote tribal district of Odisha, and distributed fruit seedlings to the farmers present on



the occasion. Technologies developed by CSWCRTI were briefed to the farmers for utilizing them for their betterment. Field training was imparted to farmers on making plantation layout, and in-situ moisture conservation practices in the field.

(ii) International Collaboration

A DST sponsored Indo-Austria project on "Application of Dynamic Simulation Models to Establish Erosion-Productivity Relationships

and Soil Organic Carbon Sequestration Potential for Future Changing Climate" between CSWCRTI, Dehradun and Institute of Hydraulics and Rural Water Management, BOKU University of Natural Resources and Life Sciences, Vienna, Austria was approved by ICAR. Dr. P.K. Mishra, Director, CSWCRTI is the Project Implementer of the project.

(iii) Consultancy Projects Initiated

- Evaluation of SMC Measures at fifteen Sites of three Divisional Management Units under Odisha Forestry Sector Development Project for the Odisha Forestry Sector Development Society, an autonomous society under Forest and Environment Department, Govt. of Odisha has been initiated by CSWCRTI Research Centre, Koraput.
- Impact evaluation studies of watershed programmes implemented by Agricultural Engineering Department, Government of Tamil Nadu under River Valley Projects in Mettur and South Pennaiyar catchments of Tamil Nadu have been initiated by CSWCRTI Research Centre, Udhagamandalam.
- MoUs of following consultancy projects have been formulated:
 - Planning and design of river training structures in Kosi River near Aamdanda Depot under jurisdiction of DFO, Ramanagar Forest Division (RFD), Ramnagar, Distt. Nainital (Uttarakhand).
 - Estimation of annual rate of sedimentation for permissible limit of minor mineral extraction on specified rivers under jurisdiction of Regional Manager (Tehri region), Uttarakhand Forest Development Corporation (UFDC), Dehradun (Uttarakhand).

(iv) Customized Training Programme Designed

A customized training programme on "Application of Remote Sensing and GIS in Natural Resource Management" for scientists of CSWCRTI has been planned and finalized from December 16-27, 2013 to be organized at IIRS, Dehradun.

(vi) CSWCRTI to Undertake Soil Conservation for IIRS

A team of scientists and technical officer led by Dr. Rajesh Kaushal, Senior Scientist will undertake bio-engineering measures for stabilization of steep slopes within the Indian Institute of Remote Sensing Campus, Dehradun damaged due to heavy rainfall.

Important Events

Contingent Planning Undertaken for Extreme Rainfall Events in Uttarakhand

A Group Meeting on "Contingent Planning in Agriculture and Allied Sectors due to Extreme Rainfall Events in Uttarakhand" was held on August 1-2, 2013 at CSWCRTI, Dehradun. The meeting on 2nd August, 2013 was held under Chairmanship of Dr. S. Ayyappan, Secretary (DARE) & Director General (ICAR), New Delhi. Dr. Ranbir Singh, Principal Secretary (Agriculture & Animal Husbandry), Govt. of Uttarakhand was the Chief Guest. Dr. A.K. Sikka, Deputy Director General (Natural Resource Management), Dr. P.K. Mishra (Director, CSWCRTI), Dr. J.C. Bhatt (Director VPKAS, Almora), Scientists of Indian Institute of Horticulture Research, Bangalore, Dr. A.K. Singh,



Zonal Coordinator, ZPD, Kanpur and Heads/Officers of ICAR Institutes/Centres of Uttarakhand; Dr Matthew Prasad, Vice-Chancellor, UHF, Bharsar and Directors of Research and Extension of UHF and GBPUAT; Director, Dr. B.S. Negi, Horticulture Mission, Dehradun; Directors of Agriculture & Animal Husbandry and representatives of KVKs participated in the meeting. Over 100 senior-level scientists and multidisciplinary technical experts from over 20 research institutes of ICAR, SAUs and KVKs under National Agricultural Research System located in Uttarakhand besides the State officials participated.

Dr. S. Ayyappan highlighted main action points on control of silts and sediments, planning for *rabi* season crops to compensate the loss incurred in ongoing *khari* season, promotion of location-specific horticultural and vegetable crops, and supply of necessary feeds, fodder and healthcare interventions for livestock and fisheries management, preferably following community approach. A strategic management plan for flood affected areas in Haridwar to remove silts from crop areas and soil erosion control measures along with suitable crop diversification in hilly areas for Chamoli, Rudrapur, Pithoragarh & Uttarkashi Districts were specified. A tentative action plan was presented to Dr. Ranbir Singh and the State Officials. Earlier, on August 1, 2013, detailed discussions on various action plans were held on agricultural crops, natural resource management, horticultural & vegetables, livestock, poultry and fisheries by expert group of subject matters from different institutions under chairmanship of Dr. A.K. Sikka to draw out workable action plans for various agricultural and allied sectors. Dr. A.K. Sikka apprised the participants that the disaster was caused by "rain-on-snow" phenomenon that happened during June 15-20 this year. He emphasized the need of doable and location-specific action plans of agricultural and allied sectors from the NARS for rehabilitation of the affected areas. At the end of two days deliberations consolidated recommendations and focussed action points with reference to various agriculture sectors specific to affected areas were drawn in consultation with State government officials and other participants to support the State functionaries.

An Action Group with its Headquarter at CSWCRTI, Dehradun was constituted consisting of representatives from ICAR Institutes, KVKs, State Agriculture and Horticulture Universities and State Government Departments dealing with agriculture and allied sectors. From ICAR, Director, CSWCRTI, Dehradun and Director, VPKAS, Almora shall be the members of this action group. Director

(Agriculture), Uttarakhand will be the representative from State Government to coordinate activities of planning, visits etc. NARS system (ICAR Institutes, SAUs & KVKs) would be working in a synergistic mode to combat the present disaster situation. A joint team will visit the disaster affected areas in Haridwar and some core villages in aforesaid four districts in Uttarakhand within a short span of time. In pursuance of decision taken in the meeting, five Joint Teams comprising Scientists/Officers of ICAR, SAUs, KVKs and State Departments of Govt. of Uttarakhand visited the disaster affected areas in Haridwar, Uttarakhand districts and suggested rehabilitation measures. In addition to these, four CSWCRTI teams visited Sainji, Fakot, Almas, Ashti, Sahastradhara, Sabhawala watershed and nearby areas to assess impact of high rainfall event in the treated watershed and outside areas.

In this regard, Dr. S. Ayyappan and Dr. A.K. Sikka along with a team of senior-level Scientists from ICAR Institutions located in Uttarakhand met Shri Vijay Bahuguna, Honourable Chief Minister, Uttarakhand and apprised him about the interaction meeting held at CSWCRTI and the action points that emerged out of the meeting to provide immediate livelihood security through agriculture and allied sectors. The CSWCRTI donated one day's salary amounting to ₹ 6 lakhs to the Prime Minister's Relief Fund for rehabilitation of the affected people and area of Uttarakhand.



ICAR Peer Review Team Visits CSWCRTI

An ICAR Peer Review Team (PRT) visited CSWCRTI, Dehradun during September 11-13, 2013 to make on the spot assessment of its suitability to offer Masters and Doctoral Degree Programmes in Integrated Watershed Management as an off-campus academic programme of Indian Agricultural Research Institute (IARI), New Delhi. Dr. Panjab Singh, Former Secretary (DARE) & Director General (ICAR), President, Foundation for Advancement of Agriculture and Rural Development, New Delhi lead the team as the Chairman. Dr. A.K. Singh, Vice-Chancellor, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior; Dr. C.L. Acharya, Former Director Research, CSKHPKV, Palampur, and; Dr. K. Sudhakara, Dean, College of Forestry, Kerala Agricultural University, Thrissur were the Members of the team constituted by ICAR. Dr. Arvind Kumar, Deputy Director General (Agricultural Education), ICAR also participated in the deliberations and on spot assessment. Dr. S.S. Honnappagol, Assistant Director General (EOR), Division of Agricultural Education, ICAR officiated as the Member-Secretary. All the Heads of



Divisions and Officers-in-Charge of various Units/Cells of the Institute actively participated in the deliberations and assessment.

The Committee visited different Divisions, Units, Cells and laboratories of the Institute and examined the different facilities, equipments, and other related infrastructures available. The PRT also visited the central library and went through the different titles, journals and other facilities available in the library. The team visited the Trainees Hostel to be used for housing the post graduate students. It also visited class rooms, bank and auditorium and examined the facilities. The team visited Institute Research Farm and had a glance of field experiments and facilities. The Peer Review Team had an Exit Meeting with the Director of the Institute.

State Level Joint Meetings of ICAR Regional Committee No. I Organized

State Level Joint Meetings of ICAR Regional Committee No. I were organized in respective state for comprising states Uttarakhand, Himachal Pradesh and Jammu & Kashmir. The meetings were held as per decision taken during XXII Meeting of Regional Committee No. I of ICAR held at HPKV Palampur on June 8-9, 2012, where it was decided that state level meetings need to be held prior to mainstreaming the issue at regional level. Being the Member Secretary of ICAR Regional Committee No. I, all the meetings were attended by CSWCRTI. For Uttarakhand, the meeting was organized at CSWCRTI, Dehradun on May 13, 2013. The Chief Guest, Dr. Aziz Qureshi, Hon'ble Governor of Uttarakhand, in his inaugural address, advised all R&D organisations of the state to work for sustainable development of the area for inclusive growth.



Dr. A.K. Sikka, DDG (NRM), ICAR, New Delhi requested for better co-ordination, collaboration and convergence approach of the organisation for the balanced development of the region. Himachal Pradesh State Level Joint Meeting was held on August 13, 2013 at Dr. Y.S. Parmar University of Horticulture and Forestry, Solan. Dr Vijay Singh Thakur, Vice Chancellor of the University in his Chief Guest address highlighted the problems of the growers of the State, giving an overview of State specific issues relating to agriculture, horticulture and allied areas. Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir under the chairmanship of Dr. Tej Partap, Vice-Chancellor organised State Level Joint Committee Meeting on June 1, 2013. Jenab Ghulam Hassan Mir, Hon'ble Agriculture Minister, GoJK attended the meeting as the Chief Guest alongwith Dr. Asgar Hassan Samoon, Commissioner/Secretary to Government, GoJK. Action Taken Reports were presented by all the participating Heads/Officers of ICAR Institutes/Centre, State Agricultural Universities, and State Line Departments against actions assigned by Regional Committee No. I in its XXII meeting. The State Line Departments and Research Organisations presented key problems and programme for addressal by research institutions of ICAR and State Agriculture Universities, and researchable, developmental and policy issues were flagged out in the meeting. It was resolved that comprehensive proposals will be formulated by the concerned in this regard. It was reiterated that joint meetings of SAUs and relevant line departments of a State is required to ensure better interactions between all stakeholders, and State Level Coordination Committee between SAUs and State Departments is a step in right direction. Modalities were worked out to prepare common agenda from a State requiring consideration of ICAR and other R&D institutions.

The Closing Ceremony at CSWCRTI, Dehradun was chaired by Shri Vijay Bahuguna, Hon'ble Chief Minister, Uttarakhand. Dr. Harak

Singh Rawat, Hon'ble Minister of Agriculture, Govt. of Uttarakhand was Guest of Honour. Both the dignitaries emphasized on R&D efforts to make hill agriculture as a productive and profitable so that out-migration may be minimized significantly. They also assured for policy, administrative and financial support to R&D organisation and also emphasized on the possible policy formulation favouring consolidation of land holding to make use of scale economies in production and marketing.

National Workshop Held

National Workshop to develop a multi-disciplinary and multi-locational inter-SMD network project "Assessment of impact of grazing by small ruminants on natural resources and surrounding environment of pasture / rangelands located in different agro-climates" was organized by CSWCRTI at Dehradun during May 15-16, 2013. Dr. P.K. Mishra, Director in his address emphasized that sustenance of pastures is required to meet high food demand over time. Therefore negative impact of grazing on our natural resources need to be understood to generate solutions. The two days workshop was attended by scientists from CSWRI (Avikanagar), CAZRI (Jodhpur), CIRG (Makhdoom), IGfRI (Jhansi), NBSSLU&P (Nagpur) and Regional stations of CSWRI and CSWCRTI. A draft of project proposal was developed. The outcome of the project will be useful in developing strategies for developing well-managed rangelands and pastures. Such rangelands and pastures will be able to support small ruminants and generate higher income to livestock farmers on sustainable basis and at the same time maintain healthy watersheds, increased carbon sequestration and greater plant biodiversity.

CSWCRTI Celebrates Foundation Days

The CSWCRTI celebrated its 40th Foundation Day on April 2, 2013 at Dehradun. The Chief Guest, Dr. R.C. Jain, Regional Director, Central Ground Water Board (CGWB), Dehradun inaugurated the day long programme and appreciated the efforts of the Institute in development and dissemination of technologies for conservation of soil, water and other natural resources. Briefing the activities and achievements of his organisation, he called for knowledge based irrigation systems and mapping of groundwater resources in order to sustain water resources. He proposed to initiate a project on spring rejuvenation in Himalayan Region in collaboration with CSWCRTI, Dehradun. Earlier, welcoming the invitees, Dr. P.K. Mishra, Director spoke on the importance and relevance of the event. Dr. G.P. Juyal, Head (H&E) & Chairman, Organizing Committee explained the achievements of the Institute during the last year. During the function, Institute staff retired during the last year were presented mementos and honoured by the Chief Guest. Two publications of the Institute were released on the occasion. The event was followed by sports meet of staff and family members, and a cultural evening.

CSWCRTI Research Centre, Datia celebrated its foundation day on September 18, 2013. On the occasion, a Field Day cum Sensitization Workshop" was organized to popularize the adoptable SWC technologies for different stake holders through field visits, presentations and documentary film show etc. Dr. P.K. Mishra,



Director along with Shri Sanket Bhondave, Collector, Datia and Shri C.S. Ninama, Divisional Forest Officer, Datia inaugurated the programme. More than 80 participants, including Deputy Director (Agriculture), Project Director (ATMA), Asstt Directors (Soil Conservation, Horticulture, Fisheries), Project Coordinator (KVK, Datia), Head (Forage Production Division, IGfRI, Jhansi), Programme Manager (Development Alternatives, NGO), educationists, students and progressive farmers from more than 6 villages attended the programme. Dr. P.K. Mishra requested the state line departments and NGOs to spread the adoptable SWC technologies in the district/region for sustainable conservation of natural resources. Prizes and certificates were distributed to winners on the occasion by the distinguished guests to winners of an essay competition among X-XII standard students on "

" organized on September 13, 2013 to develop awareness about natural resource management. About 69 students of four Schools of Datia had participated in the competition.

The CSWCRTI Research Centre, Chandigarh celebrated its 58th Foundation Day on May 8, 2013. The Chief Guest, Dr. S.C. Sharma, Regional Director, Punjab Agricultural University, Ludhiana delivered a special lecture on natural resource conservation and explained about the work done on soil and water conservation by Punjab Agricultural University in their Regional Centre at Ballawal Sonkhri in Shivaliks. Welcoming the invitees, Dr. Pawan Sharma, In-charge Head of the Centre spoke about the importance and relevance of the event. She also detailed about the contributions, achievements



and activities of the Centre over the years. During the function, retired staff of the Centre were honoured by giving mementos.

Media Meet Held for Showcasing of Soil & Water Conservation Technologies

One day Media Meet aiming to showcase soil and water conservation technologies developed by CSWCRTI, Dehradun was jointly organized with G.B. Pant University, Pantnagar at Dehradun under the project 'Mobilizing Mass Media Support for Sharing Agro-Information' on August 30, 2013. The meeting was chaired by Dr. P.K. Mishra, Director, Central Soil and Water Conservation Research and Training Institute, Dehradun. Dr. Y.P.S. Dabas, Director, Extension Education, GBPUAT; Dr. B.S. Negi, Director, Horticulture Mission, Uttarakhand; Deputy Director, Directorate of Watershed Management and Deputy Director, Agriculture of Uttarakhand State Govt. were present in the meeting. Twenty-two representatives from press and media participated in the meeting along with twenty-five progressive farmers and six line department officers.



CSWCRTI Participated in International Exhibition

The Institute participated in an exhibition during Asia-Pacific Workshop on Water and Forests - Beyond Traditional Forest Hydrology organized by Forest Research Institute in association with APAFRI and KFRI at Dehradun from September 23-25, 2013. Natural Resource Management technologies developed by the Institute and its Research Centres as well as other services offered by the Institute, viz; regular and short course trainings, consultancies and technical guidance in watershed development and management to the state agencies through out the country, were displayed during the exhibition. Suitable literature related to technologies, trainings and consultancies were also made available to the visitors. All the delegates from India and abroad (Nederland, Japan, Korea, Indonesia, Malaysia, Nepal, Bangladesh etc.) appreciated the works being done by the Institute in the area of natural resource management.

Himalayan and World Conservation Days Celebrated

The Himalayan Day was celebrated at CSWCRTI, Dehra Dun on September 9, 2013 by all taking an oath to actively protect the Himalayas, rationally use its natural resources, and conserve and improve its environment. Dr. P.K. Mishra, Director reassured all that the Institute has strived for sustainable management of Himalayas

and will continue to do so. Two special lectures by Dr. S.K. Rai and Dr. S.K. Bartarya, Senior-level Scientists of Wadia Institute of Himalayan Geology (WIHG), Dehradun were organised to understand the Himalayan ecosystems better. The lectures highlighted the implications of weathering, erosion flexes, landslides, sediment budgeting, carbon sequestration potential etc. in the Himalaya-Ganga-Bay of Bengal system. Geology of Ganga river system with the focus on weathering and erosion in Himalayas and zonation of landslides were discussed in the interaction.

World Conservation Day was celebrated by CSWCRTI Research Centre, Chandigarh, by creating awareness about natural resource management to 53 students of Motiram Arya Public School. Different conservation technologies developed by the Centre were discussed with the students in presence of scientists of various disciplines. Dr. Pawan Sharma, the In-charge Head, briefed about the event. Motivating films were screened to make the students aware about possible harmful effects of degradation of natural resources in coming future. A field visit was conducted to show the technologies developed and tested at research farm to the students. They were also appraised about the importance of rainwater harvesting, its use and other environmental aspects such as how people's needs for natural resources and their activities impact the environment. The students came forward and delivered innovative presentations on implications of natural resource conservation. Ten students were presented with awards. The students were encouraged to practice ecologically conscious habits that help conserve natural resources.



Training on Resource Conservation for Sustainable Horticultural Production Held

CSWCRTI Research Centre, Udhagamandalam organized five days capacity building programme on "Resource conservation technologies for sustainable horticultural production in the Nilgiris" from 29th April to 03rd May 2013 at Udhagamandalam. The training was sponsored by National Horticulture Mission, Department of Horticulture, Udhagamandalam. A hundred horticultural farmers from the Nilgiris participated in this training. The programme aimed to train the farmers for adopting advanced soil and water conservation and horticulture technologies in Nilgiri district. The training was inaugurated by the Chief Guest, Smt. Archana Patnaik, District Collector, The Nilgiris who urged farmers



to focus on productivity and adopt the methods being promoted by CSWCRTI and Department of Horticulture. During the training, lectures on various topics including soil and water conservation measures, water harvesting and recycling, climate change impact and adaptation strategies, advanced cultivation practices on fruits, vegetables, cut flowers, spices and plantation crops, plant protection measures, farm mechanization, post harvest technology, value addition and small scale enterprises and livelihood options were delivered. Besides the lectures, field visits to soil and water conservation and horticultural research farms and a few farm based micro scale industries were conducted. In the valedictory function, Shri Srinivas R. Reddy, Project Director, Hill Area Development Programme, The Nilgiris delivered the valedictory address and distributed certificate to farmers. He emphasized upon need to promote formation of farmers' cluster for managing natural resources in Nilgiris.

CSWCRTI Celebrates Hindi Divas/Saptah/Pakhawara

The CSWCRTI, Dehradun and its Research Centres at Datia, Koraput, Kota and Udhagamandalam celebrated Hindi *Divas* on September 14, 2013. Hindi *Saptah* was celebrated at Dehradun during September 14-21, 2013 and Hindi *Pakhawara* was celebrated at Datia, Koraput, Kota during September 14-28, 2013. The celebration was marked with diversified events. During inauguration of the celebration, different speakers spoke about the importance of Hindi in day-to-day official works and societal developments. Dr. G.P. Juyal, Head (H&E) emphasized that Hindi needs to be infused into all the scientific activities and documents of the Institute which would benefit the farmers, the prime clients



of the ICAR and other stakeholders immensely. The message and appeal on the Hindi *Divas* from Shri Sharad Pawarji, Hon'ble Minister of Agriculture, Govt. of India and Dr. S. Ayyappan, Secretary, DARE and Director General, ICAR were read out to all the staff members and circulated to all the Sections and Research Centres of the Institute. As part of celebration, various competitions, including comprehension of Hindi and English words, essay & precise writing and paraphrasing and poetry were organized. The concluding day celebration summed up the proceedings and culminated into prize distribution.

Awards and Recognitions

Dr. P.K. Mishra: National Fellowship Award of Soil Conservation Society of India on April 16, 2013.

Dr. O.P.S. Khola, Miss V. Selvi, Dr. D.V. Singh and Dr. K. Kannan: Vasant Rao Naik Award for Outstanding Research Applications in Dryland Agriculture 2012 on July 16, 2013.

Dr. Pankaj Panwar: Best Poster Award at National Seminar on "Sustainable Development of Rural India by 2022" at NITTR, Chandigarh held on March 07-08, 2013.

Mr. Suresh Kumar, Scientist: Commended as among the top five participants in the Summer School on "Decision Support System in Agriculture using Quantitative Technique" at NCAP, N. Delhi during August 2-22, 2013.

Important Publications

Research papers

Adhikari, R.N., Singh, A.K., Math, S.K.N., Raizada, A., Mishra, P.K. and Reddy, K.K. 2013. Augmentation of ground water recharge and water quality improvement by WHS in the semi arid Deccan. *Curr. Sci.* 104 (11):1534-1542.

Ajit., Dhyani, S.K., Handa, A.K., Chaturvedi, O.P., Singh, Rajender and Uma. 2013. Statistical models for growth prediction in Eucalyptus under various tree based systems. *Int. J. Agricult. Stat. Sci.* 9(1): 261-272.

Basak, B.B., Biswas, D.R. and Pal, S. 2013. Soil biochemical properties and grain quality as affected by organic manures and mineral fertilizers in soil under maize-wheat rotation. *Agrochimica.* 57 (1) : 49-66.

Devi, B., Bhardwaj, D.R., Panwar, P., Pal, S., Gupta, N.K. and Thakur, C.L. 2013. Long term effects of natural and plantation forests on carbon sequestration and soil properties in mid-hill sub-humid condition of Himachal Pradesh, India. *Range Mgmt. & Agroforestry* 34 (1): 19-25.

Madhu, M. and Hatfield, J.L. 2013. Dynamics of plant root growth under increased atmospheric carbon dioxide. *Agron. J.* 105:657-669.

Muruganandam, M., Dhyani, B.L., Bihari, B., Kumar, S., Singh, C., Mandal, D., Kumar, A. and Kumar, R. 2013. Impact assessment of extension approaches for livestock healthcare management in Indian Himalayas. *Mt. Res. Dev.* 32 (2): 132-141.

Pal, S. and Dutta, S. 2013. Transformation of microalgae into biofuels using chemical catalysts: Relevance in green energy production. *Agrochimica* 57 (1): 67-96.

Panwar, P., Pal, S., Chakravarty, S. and Alam, M. 2013. Soil quality and production of low land paddy under agrisilviculture systems in acid soil of West Bengal, India. *Range Mgmt. & Agroforestry* 34 (1): 51-57.

Rathore, A.C., Saroj, P.L., Lal, H., Sharma, N.K., Jayaprakash, J., Chaturvedi, O.P., Raizada, A., Tomar, J.M.S. and Dogra, P. 2013. Performance of mango based agri-horticultural models under rainfed situation of western Himalaya, India. *Agroforest. Syst.* DOI:10.1007/s10457-013-9646-5.

Singh, R., Ahlawat, I.P.S. and Kumar, K. 2013. Productivity and profitability of the transgenic cotton-wheat production system through peanut intercropping and FYM addition. *Exp. Agr.* 49 (3): 321-335.

Book

Madhu, M., Jakhar, P., Adhikary, P.P., Gowda, H., Sharda, V.N., Mishra, P.K. and Khan, M.K. 2013. Natural Resource Conservation: Emerging Issues & Future Challenges. Satish Serial Publishing House, N. Delhi : 984p.

Radio Talks

- Dr. G.L. Meena on "Kharif ki phaslon ke liye oorvarak prabandhan aur buvaai" at AIR, Kota on June 3, 2013.
- Sh. H.R. Meena on "Phaldar paudhon ki ropai hetu mukhya baten" at AIR, Kota on July, 2013.

Distinguished Visitors

Dehradun: Dr. S. Ayyappan, Secretary, DARE & Director General, ICAR, N. Delhi; Dr. Panjab Singh, Former Secretary (DARE) & Director General (ICAR), President, FAARD, N. Delhi; Dr. Ranbir Singh, Principal Secretary (Agriculture & Animal Husbandry), Uttarakhand Government; Dr. Gurbachan Singh, Chairman ASRB, N. Delhi; Dr. V.N. Sharda, Member, ASRB, N. Delhi; Dr. Arvind Kumar, Deputy Director General (Education), ICAR, N. Delhi; Dr. A.K. Sikka, Deputy Director General (NRM), ICAR, N. Delhi; Dr. A.K. Singh, Vice-Chancellor, RVSKV, Gwalior; Dr. Matthew Prasad, Vice Chancellor, UUFH, Bharsar; Dr. S.L. Goswami, Director, NAARM, Hyderabad; Dr. J.C. Bhatt, Director, VPKAS, Almora; Dr. Y.P.S. Dabas, Director, Extension Education, GBPUAT, Pantnagar; Dr. R. Bhalla, Director Extension, UUFH, Bharsar; Dr. A.K. Singh, Zonal Coordinator, Kanpur; Dr. Ramesh Chandra, Jt. Director Research, GBPUAT,

Pantnagar; Dr. B.S. Negi, Director, Horticulture Mission, Dehradun; Dr. R.C. Jain, Regional Director, CGWB, Dehradun; Dr. C.L. Acharya, Former Director Research, CSKHPKV, Palampur; Dr. K. Sudhakara, Dean, College of Forestry, KAU, Thrissur; Dr. S.S. Honnappagol, ADG (EQR), ICAR, N. Delhi.

Agra: Dr. B. Mohan Kumar, Assistant Director General (Agro & AF), ICAR, N. Delhi; Dr. S.K. Ambast, Project Coordinator, CSSRI, Karnal; Dr. Shrinivas Sharma, Principal Scientist (Retd.), CRIDA, Hyderabad; Dr. S.S. Thakur, Principal Scientist, NDRI, Karnal.

Bellary: Mr. A.K. Guatam, Economic Advisor and Mr. Pritam Singh, Assistant Commissioner, DoLR, MoRD, GOI, N. Delhi; Mr. L.J. Naidu and Mr. R. Sudi, Project Manager, ICRISAT, Hyderabad; Mr. Charles Ekka, Senior Administrative Officer, IIHR, Bangalore; Suresh Kumar, Chief Administrative Officer, CPCRI, Kasargod; Dr. S.V. Ramana Rao, Principal Scientist and Sh. S. Chander Rao, Scientist, DOR, Hyderabad.

Chandigarh: Dr. S.C. Sharma, Regional Director, PAU, Ludhiana.

Datia: Dr. D.N. Tiwari, Former Member of Planning Commission, New Delhi; Sh. Sanket Bhondve, IAS, District Collector, Datia; Dr. P. Rai, Ex- Director and Dr. S.K. Dhyani, Director, NRCAF, Jhansi; Dr. Anil Kumar Gupta, Head, Policy Planning, NIDM, N. Delhi; Sh. Ganesh Datt Sanwla, Bureau Chief, Dainik Bhaskar, Datia; Sh. Manoj Goswami, Bureau Reporter, Dainik Bhaskar, Datia.

Koraput: Dr. V.K. Patil, Director, Central Cattle Breeding Farm, Sunabeda; Shri S.K. Behera, Tehsildar, Semiliguda Block, Koraput; Dr. B.V. Srinivasan, SLO, Coffee Board, Pottangi; Shri R. S. Patnaik, Chief Manager, SBI, Sunabeda; Dr. Ashwin, Swastik Bahuuddesya Seva Samiti, Jagdalpur, Chhattisgarh.

Udhagamandalam: Dr. Abdul Jabbar Khan, Professor, BVET, Dhaka; Dr. Alok Kumar Khastagir, Project Manager, NJB, Kolkata; Dr. P.A. Joseph, Professor, College of Horticulture, Thrissur; Sh. P. Venkatachalam, Joint Director Agriculture, DWDA, Tamil Nadu; Sh. D. Mani, Sociologist, IWMP-IV, Perambalor; Sh. T. Vinodh, NGO, Keystone Foundation, Udhagamandalam.

Workshops and Trainings Organized

Dehradun

- Training on "Medicinal & Aromatic Plants" to farmers from Chopal Block, H.P. from June 20-22, 2013.
- Training programme (9 Nos.) sponsored by different Central and State level agencies at Dehradun.
- Training organized at HARC, Naugaon, Uttarkashi from April 25-27, 2013.
- Orientation Training of ARS Scientists: Dr. Archana Verma, Scientist (Forestry), CAZRI, Jodhpur and Er. Akram Ahmed, Scientist (SWCE), IGRI, Jhansi completed professional attachment training coordinated by Plant Science Division from May 14 - August 13, 2013; Mr. R.L. Meena, Scientist (Agronomy), NBSS&LUP, Nagpur completed professional attachment training coordinated by Soil Science & Agronomy Division from May 14 - August 13, 2013 and Er. Uday Mandal, Scientist (SWCE) completed orientation training coordinated by Hydrology & Engg. Division from April 11- May 10, 2013.

Bellary

One month training to students of B.Tech. and M.Tech. from CAET, Dapoli (MS); BCKV, Nadia (West Bengal) and College of Agricultural Engineering, UAS, Raichur (Karnataka).

Chandigarh

Workshop on "Multiple Decision Criteria for Identifying Suitable Integrated Farming Systems in Different Agro-Ecological Regions for Optimizing Resource Conservation and Productivity" by CSWCRTI, Dehradun on May 18, 2013.

Three days training programme (8 Nos.) on "Integrated Watershed Management" for WDT members sponsored by DWDA, Shimla, Dharamshala and Chamba (HP).

Datia

One month training to students of B.Tech. from Baba Saheb Dr. Bhim Rao Ambedkar College of Engg. & Technology, Etawah.

Five days capacity building programme for farmers of Narvar and Karera block of district Shivpuri (MP).

Koraput

Skill Development Programmes (13 Nos.) on "Land and Water Management in Watershed" for community level workers, secretaries, team members under IWMP sponsored by Odisha Watershed Development Mission, WMT (Engg.), Kandhamal.

Two months training to students of B.Tech. from College of Agriculture Engineering and Technology, OUAT, Bhubaneswar.

Exposure visit of watershed functionaries sponsored by Swastik Bahuuddesya Seva Samiti, Jagdalpur (Chhattisgarh).

Kota

One month training to students of B.Tech. from K.K. Wagh College of Agril. Engg. & Technology, Nasik and CTAE, Udaipur (Rajasthan).

In-house computer training for technical staff from September 17-19, 2013.

Udhagamandalam

Training programme on "Resource Conservation Technologies for Sustainable Horticultural Production" sponsored by National Horticulture Mission, Department of Horticulture, Udhagamandalam from April 29- May 3, 2013.

Training on "Evaluation of Watershed Development Programmes" implemented under WGDP, HADP and IWMP for research officers from Evaluation and Applied Research Department, Chennai (Tamil Nadu) from June 17- 21, 2013.

Training on "Watershed Concepts and Practices under Common Guidelines" for WDT Members and DWDA Officials from September 2-6, 2013.

Three days training programme (15 Nos.) on "Integrated Watershed Management" organised under IWMP for farmers/ presidents/secretaries/WDT members of Tamil Nadu and Kerala.

One month training to students of B.Tech from CAET, Mandki-Palvan (MS); JNKV, Jabalpur (MP); JAU, Junagadh (Gujarat); Centre for Water Resources Anna University, Chennai (TN) and CAE, MPKV, Rahuri (MS).

Vasad

Six days training (6 Nos.) on "Advances in Soil and Water Conservation" to the participants of Gujarat Watershed Management Agency (GSWMA).

Workshops/Meetings/Trainings Attended

Meeting to Develop Course Curriculum on Agriculture and Environment Subject for school students convened by Hindustan Newspaper at Dehradun (April 7): Dr. G.P. Juyal.

Training programme on Data Base Management System (DBMS) for Technical Personnel of ICAR at IASRI, N. Delhi (April 8-12): Mr. V.K. Jain.

National Conference on Sustainable Farming Systems and Bio-industrial Watershed Management for Food Security and Enhancing Income of the Farming Community at Lucknow (April 16-17): Dr. P.K. Mishra and Dr. R.K. Singh.

Scientific Advisory Council meeting at KVK, Barakheda and Anta in Kota and Baran districts of Rajasthan (April 16-17): Dr. Ashok Kumar.

Meeting on Programme for Diversification of Agriculture in Green Revolution Areas at Chandigarh (April 20-21): Dr. A.K. Tiwari.

Workshop on Water Harvesting and its Impact on Water Management at Dehradun (April 21): Dr. M. Muruganandam.

RAC meeting at Petroleum University, Dehradun (May 10): Dr. P.K. Mishra

State Level Review Meeting of Regional Committee No. I for Uttarakhand at Dehradun (May 13): All Scientists of Dehradun.

ILMS Training at Friedrich Schiller University, Jena, Germany (May 13-17): Dr. D.R. Sena.

Meeting with Hon'ble Chief Minister for renewal of lease deed at Dehradun (May 14): Dr. P.K. Mishra.

Meeting with Secretary (Forest) for renewal of lease deed at Dehradun (May 17): Dr. P.K. Mishra.

Meeting of Selection Committee at ASRB, N. Delhi (May 20): Dr. P.K. Mishra.

State Level Review Meeting of Regional Committee No. I for J&K at Srinagar (June 1): Dr. B.L. Dhyani.

Training programme on Geospatial Technology & Applications at NRSC, Hyderabad (June 3-Aug. 23): Dr. D. Dinesh.

India Africa Meet on Agriculture at India International Centre, N. Delhi (June 24): Dr. P.K. Mishra.

ZARC Meeting at CAD, Kota (June 26): Sh. H.R. Meena.

Farmer Interaction Meeting at Mussoorie (June 30): Dr. P.K. Mishra, Dr. G.P. Juyal, Dr. N.K. Sharma and Dr. Ambrish Kumar.

Meeting of the Directors of the Institutes under NRM and Agril. Engineering Division for discussion on Performance Indicators at NCAP, N. Delhi (July 15): Dr. P.K. Mishra and Dr. B.L. Dhyani.

Foundation Day Celebrations and ICAR Award Ceremony at NASC Complex, N. Delhi (July 16): Dr. P.K. Mishra.

Consultation Workshop on Technological Interventions for Mountain Eco-system at Dehradun (July 16): Dr. G.P. Juyal.

Seminar on Geo-Enabling Governance for State GIS at Chandigarh (July 22): Dr. A.K. Tiwari and Dr. Sharmistha Pal.

National Conference on Making Agriculture Profitable organized by RSKVV at Gwalior (July 26-27): Dr. S.P. Tiwari.

Workshop on Sustainable Rehabilitation Strategy for Disaster Affected Uttarakhand at The Institution of Engineers, Uttarakhand State Centre, Dehradun (July 27): Dr. P.K. Mishra, Dr. G.P. Juyal, Er. K.P. Tripathi and Mrs. Chayna Jana.

State Level Nodal Agencies (SLNA) meetings at Jaipur (July 30): Dr. R.K. Singh.

Management Development Programme on Consultancy Projects at NAARM, Hyderabad (August 1-7): Dr. O.P. Chaturvedi.

Preliminary meeting of Panel on Development of Environmental Indices for Uttarakhand (August 5): Dr. P.K. Mishra.

Stakeholders' Consultative Workshop on SRI as a Socio-technical Movement in India: Research with Wageningen University, Netherlands at Bhubaneswar (August 2): Dr. M. Madhu.

State Level Review Meeting of Regional Committee No. 1 for Himachal Pradesh at Solan (August 12-13): Dr. P.K. Mishra, Dr. B.L. Dhyani and Dr. Pradeep Dogra.

Sensitization Meeting on *Jal Sutra* Eco & Waste Management Programme at FRI, Dehradun (August 13): Dr. G.P. Juyal.

Brainstorming Workshop on Toxicology and Bioaccumulation Studies at HARIKE Wetland, Chandigarh (August 26): Dr. Pankaj Panwar and Dr. Sharmistha Pal.

Workshop on India-Wris Project at Chandigarh (August 27): Dr. Pawan Sharma and Dr. R.P. Yadav.

Summer School on Machinery for Natural Resource Management and Technologies at PAU, Ludhiana (August 29-September 18): Dr. Ramanjeet Singh.

Sensitization Workshop on Enhancing Water Use Efficiency in Yamuna Basin at N. Delhi (August 30): Dr. A.K. Tiwari.

NAIP - National Training Programme at IISS, Bhopal as Resource Person (August 28-29): Er. S. Patra.

Workshop on Mountain Meteorology and Landslides: A Workshop on Way Forward with Special Reference to Uttarakhand at Wadia Institute of Himalayan Geology, Dehradun (September 2-3): Dr. U.C. Maurya.

Short Course on Geostatistical Modelling for Spatio-Temporal Assessment of Soil and Water Resources at CAZRI, Jodhpur (September 2-11): Dr. Gopal Kumar and Dr. K. Rajan.

Management Development Programme on Developing Training Modules for Employees and Training of Trainers at Institute of Rural Management, Anand, Gujarat (September 3-6): Dr. Chrran Singh.

Summer School on Agroforestry as a Strategy for Adaptation and Mitigation of Climate Change in Rainfed Areas at CRIDA, Hyderabad (September 04-24): Dr. Raj Kumar.

ZREAC Meeting at Ummedganj, Kota (September 5): Dr. Kuldeep Kumar.

All India Seminar on Recent Advances in Watershed Development Programme at Ahmednagar (September 5-6):

Dr. A.K. Tiwari, Dr. Ambrish Kumar, Dr. V.C. Pande, Dr. B. K. Rao and Dr. Dev Narayan.

- Workshop on National Fund for Basic, Strategic and Frontier Application Research in Agriculture (NFBSFARA) at NDRI, Karnal (September 6-7): Dr. U.C. Maurya.
- National Workshop-cum-Discussion meeting on Himalayan Environment & Development Issues and the Way Forward at GBPIHED, Almora (September 8-9): Dr. N.K. Sharma, Dr. P.R. Ojasvi, Dr. D.V. Singh and Dr. Rajesh Kaushal.
- Meeting on RBM Mining at Kalsi, Chakrata Forest Division (September 11): Dr. D.R. Sena.
- BBLC Meeting of THDC under CSR at Rishikesh (September 12): Dr. G.P. Juyal.
- All India Seminar on Conservation & Protection of Underground Water (CPUW) at The Institution of Engineers, Uttarakhand State Centre, Dehradun (September 14): Dr. P.K. Mishra.
- National Seminar on Development and Application of Potentially Important Jute Geotextiles for Erosion Control and Rural Road Application at Kolkata (September 19): Dr. G.P. Juyal and Dr. V.K. Bhattach.
- Workshop cum SAS Installation Training for Nodal officers at IVRI, Izatnagar (September 20-21): Dr. N.M. Alam.
- All India Seminar on Conservation and Protection of Underground Water at Dehradun (September 20-21): Dr. Ambrish Kumar.
- Training Programme Governance in Science and Technology at LBSNAA, Mussoories (September 23-27) : Dr. Pradeep Dogra.
- Asia Pacific Workshop on Forest Hydrology: Water and Forests Beyond Traditional Forest Hydrology at FRI, Dehradun (September 23-25): Dr. P.K. Mishra, Dr. G.P. Juyal, Dr. O.P. Chaturvedi, Dr. Ambrish Kumar, Dr. J.M.S. Tomar and Dr. Pankaj Panwar.
- Meeting on Environmental Issues at HESCO, Dehradun (September 28): Dr. P.K. Mishra and Dr. G.P. Juyal.
- National Seminar on Bamboo Production, Propagation, Value Addition, Storage and Marketing Strategies for Rural Livelihood Development at Patna (September 28): Dr. Rajesh Kaushal.
- Meeting with Media Persons at HESCO, Dehradun (September 28): Dr. P.K. Mishra
- Twenty one days Training on Recent Advances in Statistical Modelling Techniques at IASRI, N. Delhi: Sh. Prabhat Kumar.

Personalia

Joining/Transfers

- Dr. B.N. Ghosh, Principal Scientist took over as Officer-in-Charge (Research Farm), Dehradun.
- Dr. Hrittick Biswas, Senior Scientist (Soil Science) joined at Bellary.
- Dr. B.L. Meena, Senior Scientist (Soil Science) joined at Kota.
- Dr. D.C. Sahoo, Senior Scientist (Engg.) joined at Koraput.
- Dr. U.K. Maurya, Senior Scientist (Soil Science) joined at Kota and subsequently transferred to Dehradun.
- Sh. Uday Mandal, Scientist (SWCE) joined Division of H&E Dehradun.

Dr. Ch. Jyotiprava Dash, Scientist (Engg.) joined at Koraput.

Sh. Ramesha M.N., Scientist (Forestry) joined at Bellary on transfer from Datia.

Sri Suresh Kumar, Scientist (Ag. Economics) joined at Bellary on transfer from Dehradun.

Dr. Sathiya. K., Scientist (Agronomy) joined at Chandigarh on transfer from Dehradun.

Dr. D.G. Durbude, Senior Scientist (SWC), Datia joined NIH, Roorkee.

Mr. Praveen Jakhar, Scientist (Agronomy), Koraput joined IARI, N. Delhi to pursue Ph.D.

Sh. Ghanshyam Amer, P.A. joined at Kota on transfer from Agra.

Sh. Lallan Mishra, Assistant joined at Datia on transfer from Agra.

Sh. V.A. Padmanabha, AAO joined at Udhagamandalam on transfer from Bellary.

News



Promotions

Dr. A.K. Vishwakarma, Vasad promoted to Senior Scientist Pay Band IV and joined IISS, Bhopal.

Dr. N. Loganandhan, Bellary promoted to Programme Co-ordinator and joined KVK, Hirehalli, Regional Station, IIHR.

Dr. Biswajit Mondal, Bellary promoted to Senior Scientist and joined CRR I Cuttack.

Dr. B.K. Sethy, Kota promoted to Senior Scientist and joined ICAR, Research Complex for NER, Barapani.

Smt. Kamla Rawat, CSWCRTI Dehradun promoted to AAO.

Sh. V.A. Padmanabha, Udhagamandalam promoted to AAO.

Sh. Lallan Mishra, Datia promoted to Assistant.

Sh. Rupal Singh, Chandigarh promoted to AAO.

Smt. Nisha, CSWCRTI Dehradun promoted to P.A.

Sh. Alok Kumar, CSWCRTI Dehradun promoted to Assistant.

Sh. Satvinder Singh, CSWCRTI Dehradun promoted to UDC.

Sh. Krishan Kumar and Sh. Sunil Kumar, Chandigarh promoted to UDC.

Sh. Mangi Lal Suman, Kota promoted as T-1.

Smt. D. Fathima Bi and Sh. G. Venkatesh, SSS, Bellary granted 2nd financial up gradation in the Pay Band-I.

Retirements

Sh. Devender Singh, T-5; Sh. Fateh Singh, T-5 (Dehradun); Sh. Daulat Ram, SSS; Sh. Sarnam Singh; Sh. Rajendra Singh; Smt.

Munto; Smt. Sarwati; Smt. Anar Devi. All TSLs (Agra); Er. R.N. Adhikari, Principal Scientist (Engg.); Sh. S.M. Manikatti, T-5; Sh. M. Gopinathan, T-5 (Bellary); Dr. Pratap Singh, Principal Scientist (Agronomy) and Sh. Tarlok Singh, T-5 (Chandigarh); Sh. M. J. Bairaiya, T-5; Sh. V. D. Dabhi, UDC (Vasad); Sh. J.L. Vijay, AAO, Sh. Bajrang Lal, SSS (Kota). CSWCRTI wishes them a happy retired life.

Obituary

● Sh. Om Prakash, SSS, Kota (September 10, 2013). CSWCRTI expresses heartfelt condolences to the bereaved family.

Technology

Conservation farming integrating vegetative barriers with reduced tillage, nutrient management (from organic inputs) and weed management, while fulfilling the three basic concepts of conservation agriculture i.e. minimum mechanical soil disturbance, permanent soil cover and crop diversification has

been developed. The technology comprises of FYM (5.0 t ha⁻¹) + vermi-compost (1.0 t ha⁻¹) + poultry manure (2.5 t ha⁻¹) + minimum tillage (MT) + 3 weed mulch (20, 40 and 60 days after sowing) + palmarosa (*Cymbopogon martinii*) as vegetative barrier. The tillage, manuring and mulching in kharif crop maize are as follows:

- Minimum tillage (50% reduction compared to conventional tillage) i.e. two tillage operations, one before sowing of maize crop (2/3 pre-monsoon shower i.e. between end of June to first week of July) and one after harvesting (end of September) should be done with tractor drawn cultivator at depth of =15 cm along with retention of 30% of maize residues.
- Farmyard manure @ 5 t ha⁻¹, vermi-compost @ 1.0 t ha⁻¹ and poultry manure @ 2.5 t ha⁻¹ should be applied at the time of first tillage operation and mixed thoroughly with soil before sowing of maize.
- Maize (var. Kanchan) should be sown with the onset of monsoon.
- Weeds should be cut and mulched 20, 40 and 60 days after sowing.
- Similar tillage operations should be followed for wheat crop. Wheat (var. PBW4) sowing should be completed before third week of November. One manual weeding should be done in wheat crop after 30-35 days of sowing and no manure and fertilizer should be applied to wheat crop.

Compared to recommended non-conservation farming technology having panicum (*Panicum maximum*) as vegetative barrier along with application of 100:60:40 of N:P₂O₅:K₂O with chemical weeding and conventional tillage, this palmarosa based conservation technology was observed to have many benefits. Mean runoff was ~30% lesser and mean soil loss was ~34% lesser. Mean grain yield of maize was ~10% lesser, but mean grain yield of wheat was ~57% higher. For the maize-wheat cropping system, mean wheat equivalent yield of the crop rotation was ~16% higher. Dry grass yield of 995 kg ha⁻¹ yr⁻¹ was obtained from panicum based technology whereas 610 kg ha⁻¹ yr⁻¹ was obtained from palmarosa based technology. Hence, 3.24 kg ha⁻¹ aromatic oil was obtained from palmarosa based technology. Mean soil moisture storage at grain filling stage of maize was ~7% higher and of wheat was ~27% higher. Mean soil moisture conservation for wheat was ~31%



higher. Mean water use efficiency increased by ~31 and ~40% for maize and wheat crops, respectively. Mean nutrient (NPK) use efficiency increased by ~41 and ~49% for maize and crop cycle (maize+wheat), respectively. Annual nutrient cycling through all sources increased by ~332%. Mean carbon sequestration potential increased by ~53%. Mean soil quality index increased by ~25%. Mean energy ratio increased by ~38%. Mean energy profitability increased by ~43%. Mean energy productivity i.e. energy use efficiency increased by ~70.0% and mean energy intensiveness decreased by ~56%. The palmarosa based conservation farming technology i.e. palmarosa as vegetative barrier along with organic amendments (FYM, vermi-compost and poultry manure) and weed mulching under minimum tillage should be adopted for its many advantages.

Though the technology was experimented in land slopes of 2% but it can be extended upto 8% land slope. Aromatic grass (palmarosa) based conservation farming technology is applicable in land slopes of 2-8% to the states of Uttarakhand, Himachal Pradesh and Jammu & Kashmir. This technology can be adopted by farmers of hill and mountain agro-ecosystem to conserve natural resources. The technology is beneficial particularly in increasing water productivity, checking soil degradation in respect of nutrient mining and in build up of organic matter leading to enhancing productivity. It is inexpensive and appropriate for big as well as farmers with limited resources.



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किसानों का हमसफर
मानवीय कृषि अनुसंधान परिषद

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