भाकृअनुप
ICAR

SALINITY News

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Dr. Trilochan Mohapatra assumes the responsibility as Secretary, DARE & DG, ICAR

Dr. Trilochan Mohapatra took over the charge of Secretary, DARE & DG, ICAR, New Delhi on 22nd February, 2016. Prior to this, Dr. Mohapatra served as Director-cum-Vice Chancellor of the prestigious IARI, New Delhi and as the Director of National Rice Research Institute, Cuttack, as a scientist of global repute in the area of molecular genetics, he has over 145 highly cited research papers to his credit. His major research contributions include development of the first high yielding, bacterial leaf blight resistant Basmati rice variety through marker-assisted breeding, and physical mapping and genome sequencing of rice and tomato. He is a Fellow of the Indian National Science Academy, National Academy of Sciences-India, Allahabad and the National Academy of Agricultural Sciences, New Delhi.

From Director's Desk

Consistent with the broader national goal of sustainable management of degraded lands, it is our main priority to develop farmer friendly technologies for augmenting the economic value of salt-affected soils and poor quality water. Salinity management technologies developed in the past have been adopted on a large scale in salt-affected regions of the country leading to assured returns to the farmers, generation of employment opportunities and improvements in soil quality. Despite these achievements, available evidences suggest that novel solutions must be identified to cut down the reclamation costs in a socially acceptable manner. In this context, development of salt tolerant crops capable of producing acceptable yields with negligible or no use of amendments has gained momentum. Salt tolerant cultivars of rice, wheat, chickpea and mustard developed by the Institute have been greeted with enthusiasm by the farmers in many salinized tracts. Agro-forestry trees have been recommended for arresting secondary salinity in canal commands and for reviving the productivity of deteriorated sodic soils. Identification of salt tolerant cultivars in fruit and vegetable crops is being expedited for crop diversification and attractive returns to the growers. Water, nutrient and energy use efficient resource conservation technologies have enhanced the acceptability of remunerative crops such as maize and mungbean in reclaimed soils.

The current issue of *Salinity Newsletter* provides a brief glimpse of research and extension activities carried out during January-June, 2016. Some notable research achievements during this period include: Controlled sub-surface drainage for saving irrigation water in waterlogged saline soils, Gypcal Mobile App for assisting the field personnel in gypsum-based sodic soil reclamation, development of stress tolerant rice for the poor farmers, evaluation of salt tolerance in vegetable crops and the impact of CSR-BIO application in sodic soils. For making digital salinity maps, we have recently embarked on advanced geophysical tools in collaboration with our Australian partners. An international training programme on "Participatory irrigation management for regional food and water security in northern India" was organized during 15-19 February, 2016. The 47th Institute Foundation Day was organized on 1st March 2016 Annual Review Meeting of All India Coordinated Research Project on "Management of Salt Affected Soils and Use of Saline Water in Agriculture" was organized during 6-7 May, 2016 at Karnal. A brain storming session entitled "Coastal saline soils- problems, solutions, and future research strategies" was organised at Khar Land Research Station, Panvel on 13th June 2016. '*Swachh Bharat Abhiyan*' was organized in Dabri village of Karnal on 20th January, 2016.

During the period under report, many scientists of the institute received prestigeous awards for their scientific contributions. An Australian delegation visited the Institute on 6th January, 2016 to chalk out the collaborative salinity mapping project using advanced probes. It was our pleasure to listen to Dr. Gurbachan Singh Ji, Chairman, ASRB, New Delhi, who visited the Institute on 19th February, 2016. We had an opportunity to welcome Dr. T. Mohapatra Ji, Secretary, DARE and DG, ICAR who visited the Institute on 14th April, 2016 and briefly reviewed the progress of the ongoing experiments.

(P. C. Sharma)

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SALINITY News
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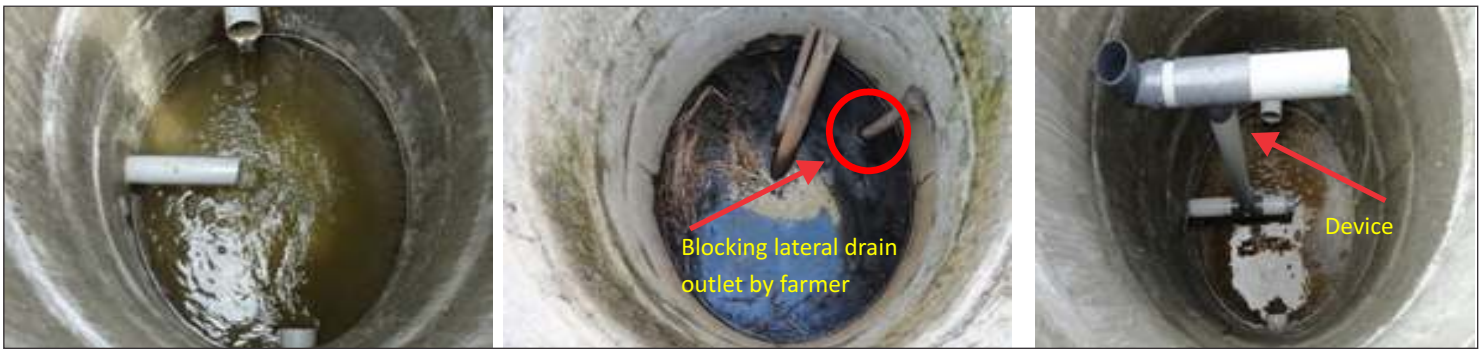
Controlled subsurface drainage to save irrigation water and fertilizer in Tunga Bhadra Project command of Karnataka

Subsurface drainage improves crop productivity in canal command areas suffering from waterlogging and salinity problems (Fig. 1a). However, excessive drainage of paddy fields under conventional subsurface drainage (SSD) not only causes irrigation water shortage during critical growth stages of rice but also results in excessive leaching of nitrogenous fertilizers. To overcome these problems, farmers used to block the outlets of lateral drains of the system (Fig.1b). In order to provide a lasting solution to this problem, AICRP on SAS&USW, Gangawathi has designed a small device made up of PVC pipes which is fitted with the outlet of lateral drain (Fig. 1c) in tail ends of Tunga Bhadra Project (TBP) command of Karnataka where paddy is grown with limited canal water. In this system, an 80 mm PVC "T" pipe fitted with outlet of lateral drain pipe inside the man hole and other end of "T" pipe is closed with end cap. The riser with variable height, depending on the minimum water table depth desired in paddy field, is fitted to this "T" pipe. Again one more "T" pipe is fitted at top of riser pipe. This simple device made up of two PVC "T" pipes and one riser pipe is efficient in maintaining desireable water table at desired depth in paddy fields. A field study for performance evaluation of conventional and controlled SSD systems was initiated in saline waterlogged Vertisols in TBP command during *Kharif* 2012 on 1.4 ha area each to understand their influences on the rate of reclamation, nutrient losses and crop yield. Initial layer wise mean EC_e of the experimental field was 6.97, 8.09, 9.43 and 10.45 dS m^{-1} for 0-15, 15-30, 30-60 and 60-90 cm depths, respectively. The saturated hydraulic conductivity (K_s) at 1 m depth was 0.397 m day^{-1}. In both conventional and controlled systems, 80 mm PVC corrugated perforated lateral pipes covered with synthetic filters were installed at 50 m spacing and 1.0 m depth at 0.1 to 0.2% slope while 100 mm PVC corrugated collector pipes, directly draining into adjacent surface drain (*Nala*), were installed at 1.10 m depth at 0.2 to 0.3% slope. In the case of controlled drainage, above explained device was fitted with lateral to control the water table depth. The results of the study over four seasons (*Kharif* and *Rabi*) revealed that average drain discharge and salinity of the drainage water were 3.28 mm day^{-1} and 3.02 dS m^{-1}, respectively, under conventional drainage compared to 1.11 mm day^{-1} and 2.95 dS m^{-1}, respectively, under controlled drainage. Thus, salt removal rate (3.51 t ha^{-1}) was more under conventional drainage as compared to 1.0 t ha^{-1} under controlled drainage. Although rate of soil reclamation was faster under conventional drainage, controlled drainage saved about 17.5% of irrigation water (104 cm vs 126 cm) and 52.5% nitrogen (5.32 kg ha^{-1} vs. 11.20 kg ha^{-1}) as compared to conventional drainage. Substantial improvements were observed in field conditions over the years (26-34%) irrespective of the drainage system. Slightly higher yield (5.14 t ha^{-1}) obtained in conventional drainage over controlled drainage (4.83 t ha^{-1}) can be compensated by savings in irrigation water and fertilizer use. Besides these direct benefits, prevention of surface water bodies from pollution was an indirect environmental benefit of ontrolled drainage.

A.V. Karegoudar, J. Vishwanath, R.H. Rajkumar, S.R. Anand, M.J. Kaledhonkar and R.L. Meena



a. Conventional subsurface drainage *b. Conventional drainage with blocking of lateral* *c. Controlled subsurface drainage*

Fig. 1. *Comparison of conventional drainage and controlled drainage*

GypCal Mobile App for researchers and field functionaries

A mobile application named GypCal has been developed for assisting field personnel and farmers in sodic soil reclamation. It works on Android platform and is user friendly. It can be immensely useful to the field functionaries, researchers, line department officials as well as farmers desirous of chemical reclamation of sodic soil for optimizing crop production in Indo-Gangetic plains by calculating the gypsum requirement in bags (of 50 kg). It also estimates the exchangeable sodium percentage of the soil and total depth of water required for salt leaching. It can also predict the expected yield of salt tolerant as well as traditional varieties of rice and wheat in reclaimed soils. The input parameters of GypCal are soil pH_2, depth of soil to be leached

Release of Gypcal by Hon'ble Secretary, DARE and DG, ICAR

and dimension of the field to be reclaimed. The output generated shall provide the gypsum quantity required in bags for heavy, medium and light textured soils besides total depth of water required for leaching soluble salts in cm and expected yield of crops (rice and wheat) both for salt tolerant as well as traditional cultivars. These ways, the software application facilitates straightforward decisions making for reclamation of sodic soil following standard protocols to optimize crop yields in Indo-Gangetic plains of North India. The Mobile App is compatible with all the smart phone handsets with Android operating system commonly available in Indian markets. The GypCal Mobile App was formally released by Dr. T. Mohapatra, Secretary DARE and DG ICAR, on 8th June, 2016. The Mobile App shall soon be made available for downloading through Google Play Store and other sources.

Sanjay Arora, Atul K. Singh, Y.P. Singh, V.K. Mishra and D.K. Sharma

Stress tolerant rice for poor farmers of Africa and South Asia

Thirty rice genotypes collected from different national and international institutes were evaluated under saline and sodic conditions in randomized complete block design under three environments *viz*., natural salinity (Nain Farm), high salinity (EC_{iw} ~10 dSm^{-1}) and high sodicity (pH_2~9.9) in microplots at ICAR-CSSRI, Karnal (Table 1). The 35 day old seedlings from wet bed nurseries were transplanted @ two seedlings per hill with a spacing of 15 × 20 cm. The recommended agronomic practices were followed to raise a healthy crop. Under high sodicity (pH_2 ~ 9.9), BULK 216 (2.60 t ha^{-1}) followed by IR 87948-6-1-1-1-3-B (2.58 t ha^{-1}) and CSR-2K-228 (2.55 t ha^{-1}) were the best entries. Under high salinity (EC_{iw} ~ 10 dS m^{-1}), entries BULK 216 (3.03 t ha^{-1}), IR 87938-1-2-2-2-1-B (3.01 t ha^{-1}) and TR 13-083 (2.99 t ha^{-1}) performed well. At Nain Farm, IR 87938-1-1-2-1-3-B (2.25 t ha^{-1}), BULK 216 (2.179 t ha^{-1}) and IR 87938-1-2-2-1-3-B (2.18 t ha^{-1}) recorded the highest yields.

Table : 1. Mean and range of grain yield and yield attributing traits under high sodicity (pH_2 ~ 9.9), high salinity (EC_{iw}~ 10 dS m^{-1}) and high salinity at Nain Farm (EC_{iw}~ 11 dS m^{-1}).

Traits	Mean			Range		
	High Sodic (pH_2~ 9.9)	Saline (EC_{iw} ~ 10 dS m^{-1})	Nain Farm (EC ~ 11 dS m^{-1})	High Sodic (pH_2~ 9.9)	Saline (EC_{iw} ~ 10 dS m^{-1})	Nain Farm (EC ~ 11 dS m^{-1})
Productive tillers $plant^{-1}$	4.70	4.82	7.74	2.67 - 7.67	2.80 - 6.80	5.20 - 9.73
Spikelet fertility (%)	39.80	39.72	35.50	10.50 -64.97	11.25 -70.75	9.51 -60.37
Grain yield (Kg ha^{-1})	1201.71	1690.45	1565.40	155 - 2604	289 - 3028	375 - 2235

S.L. Krishnamurthy, P.C. Sharma and Ravi Kiran, K.T.

Evaluation of commercial vegetable crops under protected cultivation structure in saline environments

Cultivation of high value vegetable crops under naturally ventilated polyhouses is identified as a low investment, high profit business for small landholders. It is also possible to grow vegetables under protected structures with the minimal use of crop protection chemicals owing to negligible incidence of pests and diseases. Vegetables produced during off-season also fetch remunerative prices. Although protected cultivation of vegetables is increasingly becoming popular in India, little is known about crop response and yield potential under saline conditions. Consistent with these facts, three vegetable crops namely, capsicum cv. Indra, chilli cv. Kranti and tomato cv. Cibelia were grown with saline water under a naturally ventilated

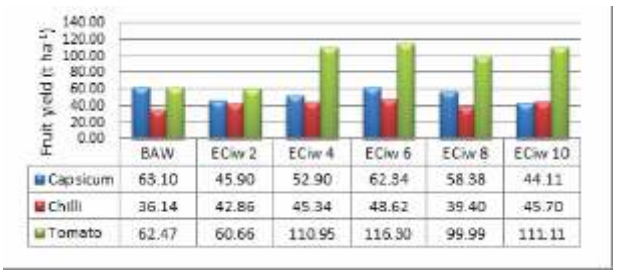


Fig. 1. Yield in different vegetable crops under saline irrigation.

polyhouse. There were six salinity treatments with irrigation water salinity (EC_{iw}) ranging from 0.8-10 dS m^{-1}. Saline treatments were initiated 15 days after transplanting (Fig. 1). Up to 15 days, all the crops were irrigated with the best available water (BAW). The vegetables were grown on raised beds of 15 cm height at 45 cm x 30 cm spacing. Drip system operated under gravity flow was used for fertigation, *i.e.,* blending of recommended dose of fertilizers with saline water. In capsicum, the highest fruit yield (63 t ha^{-1}) was obtained with BAW closely followed by irrigation with 6 dS m^{-1} (62.2 t ha^{-1}) and 8 dS m^{-1} (58.2 t ha^{-1}) water. Similarly, chilli gave the highest fruit yield of 48.5 t ha^{-1} with 6 dS m^{-1} water followed by 45.7 t ha^{-1} under 10 dS m^{-1} and 45.2 t ha^{-1} under 4 dS m^{-1} irrigation. In tomato, the maximum fruit yield (116.2 t ha^{-1}) was noted under 6 dS m^{-1} followed by 111.0 t ha^{-1} under 10 dS m^{-1} and 4 dS m^{-1} salinity treatments each. The preliminary results are encouraging and the experiment is being continued to see the changes in soil properties and crop yields under uninterrupted saline irrigation. Based on experimental findings, appropriate refinements will be made to make it a practically feasible and environmentally acceptable technology in farmers' fields.

Tomato and Capsicum plants under saline water irrigation

Capsicum and chilli fruits product with saline water.

R. L. Meena, B.L. Meena, Anshuman Singh and M.J. Kaledhonkar

Enhancing Farm Income through Crop Diversification and CSR-BIO application in Sodic Soils: A Success Story

Sh.Ajay Kumar Verma of Tejwapur village in Barabanki district of Uttar Pradesh cultivated rice and wheat crops on his 1.25 ha land. Due to alkalinity stress (soil pH 8.5-9), he obtained very low yields of these crops. In 2009, the technological intervention by ICAR-CSSRI RRS Lucknow turned his fortunes. Under scientific guidance, he started growing fruits and vegetables in sodic soils. Initially, in 2009, he planted 800 tissue culture banana plantlets (cv. G-9) and subsequently brought additional 0.125 ha under tomato cultivation in 2010-11. His net farm income increased by almost 3-fold with the horticultural crops constituting a lion's share (91%) to the total net farm income. Encouraged by the profit, he allotted more land for banana cultivation. He also started using CSR-BIO, a bioformulation developed by ICAR-CSSRI RRS Lucknow in 2012-13 to increase the productivity of banana & tomato crops. He got 14% yield increase in tomato due to use of CSR BIO. With CSR-BIO use, the average bunch weight increased from 22 kg to 26 kg per bunch. He got an average banana production of 64 t ha^{-1} with the use of CSR-BIO as compared to 56 t ha^{-1} without use (Fig 1). Increase in produce quality was also evident; CSR-BIO treated plants produced attractive and shining fruits such that he fetched additional 10% premium price for the quality produce. With this practice, he also ensured significant reductions in costs to be incurred in fungicidal sprays and fertilizer applications. The impact of banana cultivation along with the use of CSR-BIO was remarkable as his farm income increased from ₹ 61869 in 2008-09 to ₹ 540635 in 2014-15 (Table 1). Now, he has become a role model for other farmers of the district and had created awareness about the advantages of using CSR-BIO in many nearby villages. About 2400 farmers have started using CSR-BIO in different crops such as cereals, pulses, vegetables and fruits. On an average, overall impact analysis of the CSR-BIO technology indicated that farmers have got 15-30% more crop yields in sodic as well as normal soils due to CSR-BIO application.

Sh. Ajay Kumar Verma in his banana orchard

Table 1: Crop budgets of Shri Ajay Kumar Verma in different years

Crops	2008-09 (Without CSR BIO use)		2010-11 (Without CSR BIO use)		2012-13 (With CSR BIO use)		2014-15 (With CSR BIO use)	
	Area (ha)	Income (₹)	Area (ha)	Income (₹)	Area (ha)	Income (₹)	Area (ha)	Income (₹)
Rice	1.25	42961	0.5	17185	0.75	25777	0.25	8592
Wheat	1.25	18907	0.375	5672	0.625	9454	0.25	3781
Tomato	0	0	0.125	42222	0.125	56871	0	0
Banana	0	0	0.5	190683	0.5	264131	1	528262
Total	-	61869	-	255762	-	356232	-	540635

K. Thimmappa, T. Damodaran and R. Raju

Australia-India Council Collaborative Project on Salinity and Sodicity Mapping in 3D-Seeing is Believing

A geophysical survey technology (DUALEM-21) was tested at three sites (Nain in Panipat district, Mokhra Kheri in Rohtak district and Shivari in Lucknow district) to assess and map salinity and sodicity in 3D. The DUALEM-21 operates at a low frequency (9 kHz) and consists of two pairs of dual geometry horizontal (HCRA) and perpendicular (PCRA) co-planar receiver arrays at 1 and 2 m to record EM data simultaneously in both horizontal and vertical orientations to resolve soil depth up to 3 m whereas EM38 works either in vertical or horizontal orientation to resolve soil depth up to 1.5 m. Manual survey with DUALEM-21 and NovAtel GPS was carried out in January, 2016 for EM (electromagnetic) data recording where crop (mustard/wheat) was standing. The same instruments mounted on a cart pulled by car were used in Mokhra Kheri field (Fig. 1). Three kinds of transects for surveys was adopted. For technology calibration, 128 samples from 32 sampling points with four depths (0-15, 15-45, 45-75 and 75-105 cm) were collected from Nain field and it was found that 37.5% soil samples of Nain field had EC_e less than 4.0 dS m^{-1} for 0-15 cm depth whereas 62.5% samples had EC_e ranging from 4.12 to 55.5 dS m^{-1}. Four depths of soil apparent electrical conductivities (EC_a) resolved were 0-1.5 m depth by 1 m PCRA (1 m PCon), 0-3.0 m by 2 m PCRA (2m PCon), 0-0.5 m by 1m HCRA (1m HCon) and 0-1.0 m by 2m HCRA (2m HCon), respectively. Four EM conductivity images (EMCI) for 1 and 2 m PC on and HC on were generated using EM 4 soil software. The EMCI values were transformed into soil EC_e using EM4 Soil and were compared with the measured EC_e (dS m^{-1}) at four depths of Nain field (R^2=0.78). The optimal results for the EMCI image of Nain field were produced with algorithm S_2, dampness factor 0.07 and cumulative function (CF). The 3D salinity images with seven profile layers were then generated (Fig. 2). Thus, DUALEM technology makes digital salinity mapping of canal commands possible both spatially and vertically for developing improved salinity management strategies.

Fig.1. Manual and cart surveys with DUALEM-21 and GPS instruments at three sites

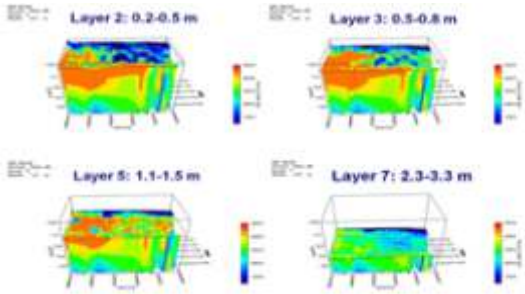


Fig.2. Displaying 3D cube of soil salinity with 2, 3, 5 and 7 layers of Nain field

D.S. Bundela, D.K. Sharma, Bhaskar Narjary and Aslam Pathan

Swachh Bharat Abhiyan

The Swachh Bharat Abhiyan was organized in Dabri village of Karnal on 20th January, 2016 to sensitize the school children about the importance of sanitation in homes and sorroundings. During this occasion, the students and teachers of Government Senior Secondary School, Dabri organized a *Prabhat Pheri* in the village under the guidance of team comprising of CSSRI scientists and the local Nagar Nigam officials. On this occasion, a quiz competition was also organized among the school students and the winners were felicitated for their understanding of environmental issues and problems. Dr. D.K. Sharma, the then Director of the institute, educated the students about the importance of cleanliness in human well being. He advised the students to carry the message to their parents and requested them to spread the message that crop residues should not be burnt. The Nagar Nigam officials educated the students and teachers about the cleanliness drive, avoiding open defecation, provision of toilet in every households, solid waste management,clean drinking water, provision for drainage, three tier pond systems, etc.

Students and teachers of Government Senior Secondary School, Dabri with Director, CSSRI

International Training Programme

A five days training of state agricultural extension officers, students and young professionals was organized at ICAR-CSSRI on "Participatory irrigation management for regional food and water security in northern India" in collaboration with

Dr. P.C. Sharma, Director (A) addressing the participants

Dr. Gurbachan Singh, Chairman, ASRB, distributing the certificates to trainees

IAFD, Australia, and CIMMYT CCAFS during 15-19 February, 2016. A total of 31 trainees attended this training programme inaugurated by Dr. P.C. Sharma, Director (A), ICAR- CSSRI, Karnal. He emphasized about the judicious use of water in irrigation and cautioned about the rapidly declining fresh groundwater. The programme specifically aimed to enhance the skills and knowledge of the trainees to effectively address the emerging constraints in soil and water management for profitable crop production. The diverse issues related to climate smart agriculture, irrigation management under water scarcity and innovative participatory extension approaches were also discussed. Field visits and practical exercises were also conducted to enhance the skills of the participants. Dr. Gurbachan Singh, Chairman, ASRB, New Delhi and Chief Guest of the Valedictory Function observed that development and dissemination of innovative technologies for the rational and profitable use of marginal land and water resources are of utmost importance in the rapidly changing scenario.

Institute Foundation Day

ICAR-CSSRI, Karnal celebrated its 47th Foundation Day on 1st March 2016 by organizing a Foundation Day lecture delivered by Dr. Arvind Kumar, Vice-Chancller, Rani Laxmi Bai Central Agricultural University, Jhansi. On this occasion, Dr. D.K. Sharma gave a glimpse of Institute's achievements and highlighted the future research priorities. Dr. Arvind Kumar addressed the gathering on the topic 'Sustainable approaches for crop production technology in salt-affected soils'. He said that during the last four decades natural resources have been over exploited to meet food, fibre and shelter requirements of the burgeoning human and livestock populations. He added that as a finite and non renewable natural resource on a human time scale, productive soils are increasingly subject to degradation and pollution and are also being usurped by other sectors of the economy. Given the fact that soils are the foundations for food, feed, fuel and natural fibre production and also offer a range of ecosystem services, generating awareness about the life-supporting functions of soil is urgently required to reverse the degradation trends. In fact, it is the only way to achieve the levels of food production necessary to meet the projected food and nutrition demands by 2050. He appreciated the efforts of ICAR-CSSRI through technology-led productivity enhancements in degraded saline and sodic lands in different agro-ecological regions of the country. He said that technologies developed by the Institute such as gypsum-based reclamation package for sodic soils, sub-surface drainage of waterlogged saline lands, salt tolerant varieties and agro-forestry systems have gained wide international and national recognition. Taking a note of the fact that problems of soil salinity and poor quality water are bound to significantly increase in the ensuing decades and that climate change induced stressors will further accentuate the rate of soil and water degradation, he called for focused attention to effectively address these challenges. About 200 scientists and other officers from Karnal based ICAR institutes participated in this function.

Dr. Arvind Kumar delivering the 47th Institute Foundation Day Lecture

Rabi Kisan Mela

Rabi Kisan Mela was organized on 5th March 2016 at Karnal which was inaugurated by Shri Harvinder Kalyan, Chairman, HAFED, Govt. of Haryana and Chief Guest of the function. Over 2000 farmers and students took active part in the Kisan Mela and benefitted from agricultural technologies showcased by 53 different institutions and private companies. Shri Kalyan appreciated the efforts being made by ICAR-CSSRI for the dissemination of soil and water reclamation technologies benefiting the farmers in salinity affected regions of the country. He requested the farmers to benefit from different schemes of the Central and State governments. He emphasized the need for a close co-ordination among different stakeholders to tackle the problems caused by salinity, climate change and socio-economic issues. During the Mela, a 'Farmer-Scientist Kisan Goshthi' was also organized to address the farmers' concerns relating to poor quality water, waterlogged salt-affected lands and the timely availability of the seeds of salt tolerant varieties. Dr. D. K. Sharma, Director, ICAR-CSSRI highlighted the contributions made by the Institute in strengthenening the farmers' livelihoods in salt-affected regions through the development and transfer of salinity management technologies. The water samples brought by the farmers were analysed free of cost and the advisories were issued on the spot. Seeds of salt tolerant and other rice varieties (CSR 43, CSR 30, and Pusa 44) were also sold to the farmers.

Sh. Harvinder Kalyan, Chairman, HAFED, Govt. of Haryana, inaugurating the kisan mela

Annual Review Meeting of AICRP on SAS and PQW

Annual Review Meeting of All India Coordinated Research Project on "Management of Salt Affected Soils and Use of Saline Water in Agriculture" was organized during 06-07 May, 2016 at ICAR-CSSRI, Karnal. Dr. P.C. Sharma, Director (A) welcomed the Chief Guest Dr. S.K. Chaudhari, ADG (Soil & Water Management), ICAR and apprised him about the achievements of 12 centres of the scheme operational in different agro-climatic zones of the countary. He emphasized that research being conducted at these centres aims to reduce the cost of cultivation and double the farmers' income by 2022. Dr. S.K Chaudhari appreciated the progress of the scheme and expressed happiness that farmers have benefitted through technologies developed by these centres. He stressed the need to develop location specific technologies for different agro-climatic conditions as well as to address the limitations being posed by the climate change. During concluding session, Dr. D.K. Sharma, Ex. Director, ICAR-CSSRI said that there is a need to promote integrated farming and crop diversification to ensure more income per unit of land and water. Dr. M.J. Kaledhonkar, Project Coordinator discussed the future action plan to improve the overall research output of the scheme.

Dr. S.K. Chaudhari, ADG (SWM) addressing the participants

Brain Storming Session on "Coastal saline soils- problems, solutions, and future research strategies"

A brain storming session entitled "Coastal saline soils- problems, solutions, and future research strategies" was organised by AICRP on SAS&PQW, Panvel, Maharashtra (Volunteer Centre) and Dapoli Chapter of ISCAR, Canning Town, West Bengal on 13th June 2016 at Khar Land Research Station, Panvel. Dr. Tapas Bhattacharya, Vice Chancellor , Dr. BSKKV, Dapoli inaugurated the session which was attended by many noted researchers and officers engaged in coastal salinity management. The ingress of sea water and reclamation measures, crop production issues, nutrient management, salt tolerant rice varieties and other alternative crops, management of farm ponds, etc. were thoroughly discussed during this occasion.

Brain Storming Session in progress

Notable publications

Basak, N., Datta, A., Mitran, T., Singha Roy, S., Saha, B.N. and Mandal, B. 2016 Assessing soil quality indices for sub-tropical rice-based cropping systems in India. *Soil Research,* 54: 20-29.

Bhardwaj, A.K., Nagaraja, M.S., Srivastava, S., Singh, A.K. and Arora, S. 2016. A framework for adaptation to climate change effects in salt affected agricultural areas of Indo-Gangetic region. *Journal of Soil & Water Conservation,* 15: 22-30.

Meena, M.D., Joshi, P.K., Jat, H.S., Chinchmalatpure, A.R., Narjary, B, Sheoran, P. and Sharma D.K. 2016. Changes in biological and chemical properties of saline soil amended with municipal solid waste compost and chemical fertilizers in a mustard-pearl millet cropping system, *Catena* 140: 1-8

Singh, A.K., Verma, C.L., Singh, Y.P., Bhardwaj, A.K., Arora, S. and Singh, D. 2016. Irrigation water and pumping energy use trends in rice (*Oryza sativa* L.) under varying irrigation regimes in partially reclaimed sodic soils. *Journal of Soil & Water Conservation* 15: 52-57.

Dagar, J.C., Yadav, R.K., Tomar, O.S., Minhas, P.S., Yadav, G. and Lal, K. 2016. Fruit-based agroforestry systems for saline water-irrigated semi-arid hyperthermic camborthids soils of north-west India. *Agroforestry Systems,* DOI 10.1007/s10457-015-9889-4.

Awards

- Dr Randhir Singh was conferred the 'Best Paper Award' during the International Conference on Global Warming and Biodiversity Conservation (ICGB-2015) held at Dubai, UAE during 09-11 February, 2016.
- Dr. A.K. Bhardwaj was bestowed the 'Best Poster Award' during the 25th National Conference on Natural Resource Management in Arid and Semi arid Ecosystems for Climate Resilient Agriculture and Rural Development held at SKRAU, Bikaner during 17-19 February, 2016.
- Dr. S.K. Kamra, Principal Scientist, ICAR-CSSRI, Karnal and Dr. S.K. Dubey, Head, ICAR-IIS&WC, RRS Chhalesar, Agra were jointly conferred the 'ICAR-CSSRI Excellence Award' on Soil Salinity and Water Management for the Year 2014.
- Dr. P.C. Sharma, Head, Crop Improvement Division, ICAR-CSSRI, Karnal and Dr. V.K. Mishra, Head, ICAR-CSSRI, RRS Lucknow were jointly conferred the 'ICAR-CSSRI Excellence Award' on Soil Salinity and Water Management for the Year 2015.
- Dr. Randhir Singh was conferred the 'Outstanding Achievement in Agriculture Award 2015' by the Society for Recent Development in Agriculture, Meerut, India.
- Dr. T. Damodran was conferred the 'Excellence of Research Award 2016' by Samagra Vikas Welfare Society, Lucknow, India for outstanding research in organic horticulture.
- Dr. Anshuman Singh was conferred the 'Young Scientist Award' by the Society for Upliftment of Rural Economy, Varanasi during the National Conference on Rural Livelihood Security through Innovative Agri-enterpreneurship held at Patna, India during 12-13 March, 2016.
- ICAR-CSSRI best worker awards for Technical, Administrative and Skilled Supporting Staff for the year 2015:
  - Sh. H.S. Tomar, ACTO
  - Sh. Raj Pal, TA
  - Smt. Jasbir Kaur, Assistant
  - Sh. Satya Narain Sharma, Assistant
  - Sh. Rajkumar, SSS
  - Sh. Desh Raj, SSS

Distingused Visitors

Director General, ICAR and Secretary, DARE, New Delhi addressing the Scientists of ICAR-CSSRI, Karnal on April 14, 2016

Chairman, ASRB, New Delhi, visiting the experimental areas of the Institute on February 19, 2016

Director, ICAR-CSSRI dicussing the research issues with the Australian delegation on January 6, 2016

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