Agrisearch with a human touch

SALINITY News

Vol. 23, No. 1 | एक कदम स्वच्छता की ओर | January-June, 2017

From Directors' Desk

Globally, twin menaces of salinity and waterlogging impair the productivity of ~1000 M ha croplands to varying extents. Salt-induced land degradation is often more severe in areas having saline groundwater. In India, salt-affected area may expand to 16.20 M ha by 2050. Investments in technology development are an attractive option to enhance the economic value of the degraded lands in terms of higher crop yields and regular incomes to the farmers. Conventional chemical and engineering interventions for mitigating the salt stress are essentially reactive in nature and often involve high initial and operational expenses. As resource poor farmers may not be able to meet such higher costs, emphasis has increased on developing low cost proactive measures to address the intertwined objectives of arresting the salinization of new areas, harnessing the potential of deteriorated lands and sustaining the productivity of reclaimed soils. Recent innovations in plant-based solutions, irrigation management and farmers' skill development for increased adaptation to salinity have captured our imagination.

Some of the notable research and extension achievements during January-June, 2017 period given in the current issue of Salinity Newsletter include: release of salt tolerant Indian mustard variety 'CS 58', underground taming of floods for irrigation, identification of high yielding maize cultivars for the saline Vertisols, success of salt tolerant rice variety 'CSR 43' in reclaimed sodic areas, technology for reviving abandoned aqua ponds in coastal Andhra Pradesh, drip irrigation for saline water use in wheat in arid Rajasthan and socio-economic benefits accruing from the reclamation of salt affected lands.

A 3-days training programme on 'Sustainable production in salt-affected agroecosystems: Problems and solution' was organized during 11-13 January, 2017. The 25th Biennial Workshop of AICRP (SWS) and the 5th National Seminar on 'Climate Resilient Saline Agriculture: Sustaining Livelihood Security' were organized during 19-20 January, 2017 and 21-23 January, 2017, respectively, at Bikaner. National Drainage Stakeholders' Consultation Meeting was organized on 6th February 2017. National Productivity Week was celebrated during 12-18 February, 2017. 'National Science Day' was celebrated on 28th February 2017. Institute celebrated its 48th Foundation Day on 1st March 2017. Rabi Kisan Mela was organized on 8th March, 2017. A 4-days training programme on 'Sustainable management of crop productivity in salt affected soils and poor quality waters' was organized for Maharashtra farmers from 5-8 June, 2017. Some notable visitors to the Institute during this period were Prof. V. P. Sharma, Chairman, CACP, Dr. A. K. Sikka, Ex. DDG (NRM), Dr. K. Alagusundaram, DDG (AE & NRM), Dr. A. K. Singh, DDG (Agric. Extn.), ICAR. We congratulate the colleagues who got promoted and wish a happy retired life to those who retired after rendering valuable services to the Council. Constructive comments from the readers to further improve the contents of the Newsletter will be appreciated.

(Parbodh Chander Sharma)
Director

In This Issue.....

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CS 58: a new salt tolerant high yielding variety of Indian mustard released

ICAR-Central Soil Salinity Research Institute (CSSRI), Karnal has developed new variety CS58 of Indian mustard. This variety, developed by a team of Drs. P. C. Sharma, Jogendra Singh and D. K. Sharma as Developers and Drs. S. K. Sharma (CCSHAU, Hisar), Y. P. Singh (CSSRI-RRS, Lucknow) and R. B. Singh (AICRP SWS, Agra) as Co-operators, has been recommended by the Central Sub-Committee on Crop Standards, Notification & Release of Varieties for the states of Haryana, Uttar Pradesh, Punjab, Delhi and Rajasthan (North Western Plain Zone) under salt stress and timely sown conditions. This variety showed superior performance over nationally adapted high yielding checks continuously for four years with respect to seed and oil yield *per se* under moderate to high salinity and alkalinity conditions in salt affected soils.

Variety CS58 produces seed yield of 2.0-2.2 t ha^{-1} under saline and 2.6-2.8 t ha^{-1} under normal conditions, which is ~25% higher than high yielding checks. It has about 40% oil content and records 29% higher oil yield over the national checks. Plants mature in 135 days, attain height of approximately 180 cm and 1000 seed weight of 5-5.5g. This variety also shows resistance to *Alternaria blight* under natural conditions and very less incidence of white rust, powdery mildew, downy mildew, stag head and sclerotinia stem rot, and very low mustard aphid infestation index compared to checks Rohini, YSB-9, RTM-314 and salt tolerant variety CS 54.

P.C. Sharma, Jogendra Singh, D.K. Sharma, S.K. Sharma, Y.P. Singh and R.B. Singh

Underground Taming of Floods for Irrigation (UTFI)

Prime Minister Krishi Sinchai Yojna (PMKSY) lays emphasis to achieve the convergence of investments in irrigation at the field level, expand cultivable area under assured irrigation (*Har Khet ko Pani*), enhance recharge of aquifers and introduce sustainable water conservation practices . For achieving these goals, aquifer recharge is of utmost importance. Groundwater depletion has become a major concern among the researchers and planners. The problem has become so acute that the State Government of Uttar Pradesh has decided to stop free boring, deep bore wells and private tube wells in 108 over exploited blocks of 34 districts. Underground Taming of Floods for Irrigation (UTFI) is viable solution to tackle the twin problems of floods and droughts to protect and safeguard lives, property and livelihoods**.** It involves diverting high water flows from rivers or canals, at times this poses a flood risk and recharging the groundwater via village ponds modified with low cost recharge structure. Under a pilot study in collaboration with IWMI, village Jawai Jadid in Rampur district, Uttar Pradesh was selected after close consultation with the local people and authorities. The site has a community pond (*Gram Panchayat* owned) located close to the road and canal system (Pilakhar minor). The pond was cleaned and the soil excavated was used to dress the pond dykes. To prevent wastewater entry into the pond, it was diverted away through a drainage channel constructed specifically for this purpose. Ten recharge wells (Fig 1) were drilled and constructed in the pond. A PVC pipe of 150 mm in diameter was installed in the center with gravel filters around them. The height of these structures from the bottom of the pond was 1 m and was packed with pea gravels to filter out suspended silts and ensure higher rates of groundwater recharge. Five of these recharge were of 3 m diameter and five other recharge wells were 1.5m diameter .The depth of the 5 wells with 3 m diameter filter chambers was 30 m and the 5 wells with 1.5 m diameter chamber was 24 m. The source water i.e., excess rain water/flood water is brought through a canal to pond for ground water recharge. The pilot site is intended to serve as a demonstration of UFTI in practice as well as a scientific trial to establish the technical performance and socio-economic benefit.

Pre implementation

Post implementation

V.K. Mishra, C.L. Verma, S.K. Jha and IWMI Team

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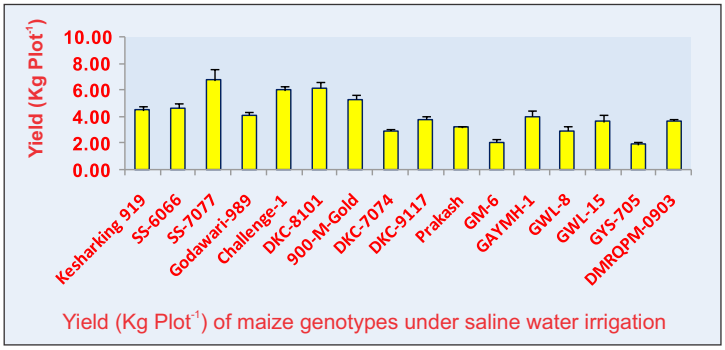
High yielding maize cultivars identified for the salt affected Vertisols of Gujarat

Selection of salt tolerant cultivars is considered as one of the best management options for the salt affected soils because of cost effectiveness and the ease in adoption over a large area. Maize is an important grain and fodder crop (dual purpose) of Western India; especially Gujarat state. Expanding maize cultivation in saline Vertisols could be a viable strategy to alleviate the problem of fodder shortages for the commercial dairy sector. Although maize is considered as a moderately salt sensitive crop, marked genotypic differences have been noticed for salt tolerance. For example, maize hybrids exhibit comparatively higher tolerance to abiotic stresses than varieties/open pollinated varieties. In this backdrop, an experiment was conducted at ICAR- CSSRI Regional Research Station, Bharuch (Gujarat) for the selection of high yielding salt tolerant maize genotypes. Over 100 germplasm lines, comprising of hybrids and varieties (synthetics, composites and OPVs) collected from public sector institutions and private seed companies were screened. Two trials, namely hybrid and varietal trial, were conducted separately on salt affected Vertisols with local *desi* variety as check. Crop was irrigated with saline water (EC_{iw} 3.0-3.5 dS m^{-1}) and recommended agronomical practices were followed. Soil salinity (EC_e) of the experimental field increased from 4.2 dS m^{-1} to 4.6 dS m^{-1} during the course of investigation. All the maize cultivars responded well to saline irrigation. After three years of testing and pooled analysis of data, DKC-8101 (7.74 t ha^{-1}) emerged as the best hybrid under saline conditions followed by SS-7077 (7.26 t ha^{-1}). SS-7077 (1.43 t ha^{-1}) was the best hybrid in terms of biomass production. High biomass and maintenance of better K^+/Na^+ ratio were found to be highly correlated with grain yield in the superior hybrids. DKC 8101 maintained higher proline and chlorophyll levels compared to other hybrids. Public sector hybrid Prakash and PMH-4 also had good yield potential under saline irrigation. Among varieties and composites, DMRQPM-0903 (4.65 t ha^{-1}) and GM-6 (2.56 t ha^{-1}) were superior for yield and related attributes. The farmers, who earlier cultivated low yielding *desi* white variety, now have more options to obtain higher maize yields under moderate saline conditions.



Yield (Kg Plot^{-1}) of maize genotypes under saline water irrigation

Indivar Prasad, Anil R. Chinchmalatpure, Shrvan Kumar, David Camus D. and Sagar Vibhute

Adoption of salt tolerant rice variety 'CSR 43' enhances farm income in reclaimed sodic areas of Indo-Gangetic plains

A field experiment consisting of five rice based cropping systems *viz*., rice-wheat, rice-toria-wheat, rice-spinach-wheat, rice-cabbage-wheat and rice-beetroot-wheat was conducted at ICAR-CSSRI Shivri Experimental Farm, Lucknow with the objective of increasing the cropping intensity and farm income by introduction of short duration salt tolerant rice variety 'CSR 43' and to find out economically viable rice based cropping systems for the reclaimed sodic soils of Indo-Gangetic plains. With the introduction of CSR 43, cropping intensity of partially reclaimed sodic soils increased from 200% to 300%. Early maturity of CSR 43 enables the farmers in saving the cost (~Rs. 6000/ ha^{-1}) incurred on two to three irrigations. In addition to curtailing the cost of production, such water savings assume significance for conserving the rapidly depleting groundwater. With the adoption of CSR 43 rice based cropping system, it is possible to take additional short duration crops such as toria, spinach, cabbage and beetroot in between traditional rice-wheat cropping system for fetching the additional income. Cost economics calculated on the basis of support price of rice, toria and wheat and the market price of cabbage, spinach and beet root showed that maximum income was recorded with rice-cabbage-wheat cropping system. However, the maximum rice equivalent yield was recorded with rice-beetroot-wheat cropping system (Table 1).


Additional short duration crops between rice and wheat

Table: 1.Cost economics of CSR-43 rice based Cropping systems

Crop rotations	Yield of produce (t ha^{-1})			Rice equivalent yield (t ha^{-1})	Net income (Rs. ha^{-1})
	Ist crop	IInd crop	IIIrd crop		
Rice-Wheat	5.20	2.64	-	7.72	52910
Rice –Toria-Wheat	5.20	0.85	1.97	9.9	62911
Rice -Spinach -Wheat	5.20	12.40	2.36	11.01	84330
Rice-Cabbage-Wheat	55.20	14.75	2.33	10.86	115090
Rice-Beetroot-Wheat	5.20	12.80	2.00	16.61	120800

Y.P. Singh, V.K. Mishra, Himanshu Dixit

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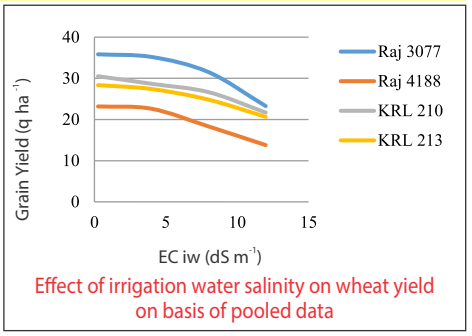
Wheat cultivation with saline groundwater irrigation using drip in arid Rajasthan

A field experiment to study the effects of saline irrigation on yield attributes and yield of wheat varieties under drip irrigation was carried out for two consecutive years at SK Rajasthan Agricultural University, Bikaner, Rajasthan. Treatments comprised of four irrigation water salinity (EC_{iw}) levels: 0.25 dS m^{-1} [Best Available Water (BAW)], 4, 8, and 12 dS m^{-1} and four wheat varieties (Raj 3077, Raj 4188, KRL 210 and KRL 213). Salinity level of each treatment was regularly monitored and maintained throughout the growing period. The highest grain and straw yields of wheat were recorded with BAW which differed non-significantly with EC_{iw} 4 dS m^{-1}. Variety Raj 3077 proved superior over other tested varieties at all levels of EC_{iw}. In general, grain yields declined with the increasing salinity of irrigation water. However, different wheat varieties performed differently at different salinity levels. The maximum salinity was observed in 0-15 cm soil depth which decreased in the sub-surface layers (15-30 cm and 30-45 cm) at all levels of EC_{iw}. Drip irrigation along with salt tolerant wheat variety provides an opportunity to use saline water judiciously without any drastic reduction in the yield. On basis of cost on drip per ha assuming optimal life of drip as 10 years, cost of cultivation for wheat and benefits, B: C ratios for these varieties with BAW were computed to be 2.36, 1.68, 2.06 and 2.01, respectively. In conclusion, combination of drip irrigation and wheat variety (Raj 3077) proved effective in ensuring higher B: C ratio (>2) and higher water productivity (> 0.75 kg m^{3-}) for wheat crop. This approach may ensure long-term sustainability of crop production in arid climatic condition.

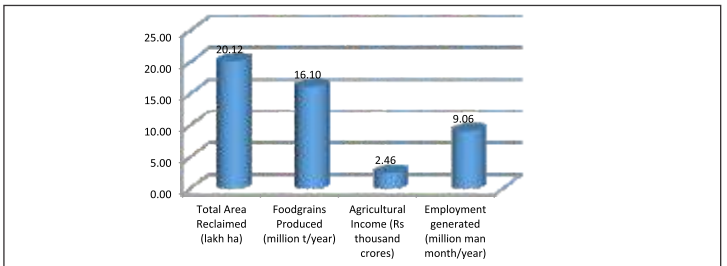


Effect of irrigation water salinity on wheat yield on basis of pooled data

I.J. Gulati, N.S. Yadava, A.K. Singh, Deepak Gupta, R.L. Meena and M.J. Kaledhonkar

Socio-economic benefits of salt affected land reclamation in India

In India, about 6.73 M ha area is salt-affected, of which 3.77 M ha is sodic and 2.95 M ha saline. Recent estimates showed that India annually loses about 16.84 million tonnes of farm production valued at Rs. 230.19 billion due to salinity and sodicity. The technologies developed and recommended by ICAR-CSSRI for the reclamation of salt affected soils *viz*., gypsum technology for sodic soils and subsurface drainage technology for waterlogged saline lands have contributed significantly in reducing the production losses in saline areas of the country. With the help of these technologies, about 20.12 lakh ha salt affected land has been reclaimed in the country till 2015-16, out of which 19.5 lakh ha is sodic and remainder 0.61 lakh ha saline. The socio-economic benefits estimated from reclamation of salt affected soils at the national level during 2016-17 are: the annual contribution of about 16.1 million tonnes of foodgrains production; about Rs. 2.46 thousand crore income generation from agricultural production and about 9.06 million man months employment generation.



Socio-economic benefits of salt affected land reclamation in India

Raju, R and P.C. Sharma

Farmers training under Farmer FIRST project organized

A three days training programme on "Sustainable production in salt affected agroecosystems: Problems and solutions" was organized under Farmer FIRST project during January 11-13, 2017. Thirty three farmers from adopted villages, *viz*., Mundri, Geong, Kathwar, Bhaini Majra and Sampli Kheri of Kaithal district participated in this training. Dr. P.C. Sharma, Director highlighted the contribution of salinity management technologies in improving the farmers' lives in different parts of the country. He stressed upon the adoption of salt tolerant varieties of rice, wheat and mustard in salt affected areas. Dr. Randhir Singh, ADG (Agril. Extn.), stressed that such trainings provide a farmers-scientist interface for problem identification, setting up the research priorities and bridging up the technological gaps.

Dr. Parvender Sheoran, training coordinator, briefed about different initiatives.

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Biennial Workshop of AICRP on SAS&USW

The 25th Biennial Workshop of All India Coordinated Research Project on Management of Salt Affected Soils and Use of Saline Water in Agriculture was organized during 19-20 January, 2017 at SKRAU, Bikaner. Dr. V. N. Sharda, Member, ASRB, New Delhi and Chief Guest of function inaugurated Biennial Workshop on 19th January, 2017. During two days deliberations, OICs/ Nodal officers presented progress reports for 2014-16 and proposed new research projects which were discussed thoroughly and comprehensively. Dr. M. J. Kaledhonkar, Project Coordinator thanked ICAR and different stakeholders for the guidance and support for research projects coordinated by the AICRP.

Dr. V.N. Sharda, Delivering a inauguration lecture

National Seminar on Climate Resilient Saline Agriculture

Indian Society of Soil Salinity and Water Quality (ISSSWQ) organized the 5th National Seminar on"**Climate Resilient Saline Agriculture**: Sustaining Livelihood Security" in collaboration with SKRAU, Bikaner and ICAR-CSSRI, Karnal during 21-23 January 2017 at SKRAU, Bikaner. Dr. Gurbachan Singh, Chairman, ASRB, New Delhi inaugurated the seminar and Dr. B.R. Chhipa, Vice Chancellor, SK RAU, Bikaner presided over the function. Dr. Gurbachan Singh, in his inaugural address, lauded ICAR-CSSRI, Karnal for the systematic researches culminating into technology packages for the reclamation and management of salt affected soils and poor quality waters. Taking a note of the emerging constraints, he stressed the need to employ frontier techniques for sustained gains from the soil reclamation efforts. Dr. B.R. Chhipa advised the farmers' to follow scientific recommendations for the judicious use of precious soil and water resources in crop and livestock production. Dr. G. L. Keshwa, Vice Chancellor, Agriculture University, Kota suggested that only collective and concerted efforts can tackle the problem of salinity/alkalinity under a climate change scenario. Dr. A. K. Gahlot, Vice Chancellor, RUVAS, Bikaner echoed the sentiments for developing synergy between SAU's and CSSRI, Karnal for expediting the reclamation of saline soils and poor quality ground water.

Dr. Gurbachan Singh, Chairman, ASRB, New Delhi, delivering inaugural address at Bikaner

National Drainage Stakeholders' Consultation Meeting Organized

National Drainage Stakeholders' Consultation Meeting was inaugurated by Dr. A.K. Sikka, India Representative, International Water Management Institute, New Delhi at ICAR-CSSRI, Karnal on 6th February 2017. The meeting was organized to address drainage issues related to variation in design parameters, installation procedures and costs of sub-surface drainage (SSD) systems for various agro-ecological regions of India. Dr. Sikka informed that irrigation got priority over drainage during the Green Revolution period. This has resulted in loss of prime lands and reduced crop productivity in general irrigation projects due to waterlogging and salinity. He emphasised that it is the right time for

Meeting in Progress

integrated management of irrigation projects where drainage should not be dealt in isolation. Dr. S. K. Chaudhari, ADG (SWM), ICAR stressed that SSD technology developed by ICAR-CSSRI is well recognized. He appreciated the efforts underway to provide concrete drainage guidelines to address the problems being faced by different stakeholders including funding agencies and farmers. Dr. P.C. Sharma, Director highlighted the chemical, engineering and biological approaches developed for the management of sodic and waterlogged saline lands. He informed that these technologies have been instrumental in reclaiming around 2.07 Million ha salt-affected lands and assured that efforts are being made to deal with the second generation problems. Dr. S.K. Gupta, Ex-PC, AICRP (SWS) and Chairman, National Drainage Committee apprised that the Committee has referred all the existing literature and used expertise at national level in drafting SSD guidelines and hoped that these guidelines will be relevant and useful in streamlining the large scale installation of SSD projects through state departments or in public-private-partnership mode. Dr. D. S. Bundela, Head, DIDE gave an overview of drafted drainage guidelines and cost estimation procedures. Thirty-four officers, engineers and scientists from 12 affected states (Punjab, Haryana, Delhi, Rajasthan, Gujarat, Maharashtra, MP, UP, Karnataka, Andhra Pradesh, Tamil Nadu, and Kerala), and representatives from leading drainage industries, participated in the deliberations during the meeting.

National Productivity Week Celebrated

National Productivity Week on the theme "*From Waste to Profits Through Reduce, Recycle and Reuse*" was organized at the Institute during February 12-18, 2017. A total of 25 school children participated in the painting competition under the theme "*Sustainable use of Waste in Agriculture for Healthy Soil and Healthy Humans*". These school children showed their creativity, awareness and knowledge about how best agricultural wastes including cow dung, crop residues, kitchen waste and non-organic waste can be productively utilized through the recycling process. In this series, different programmes on recycling of rice residue and the sustainable management of kitchen wastes were also organized for the farmers and rural women.

Visit of School Children to Multienterprise experiment

National Science Day celebrated

'National Science Day' was celebrated on 28th February 2017. A programme on the theme 'Science and Technology for Differently Abled Persons' was organized at Sant Nikka Singh Public School of Zarifa Viran village, Karnal. At the outset, Principal of the School Ms. Gurvinder Kaur Tuli informed the gathering about educational and extracurricular activities being carried out in the school. Dr. P. C. Sharma, Director motivated the students to set high goals in life and put all the efforts to achieve them. Dr. Sharma briefed the importance of organizing this function and exhorted the students to help the differently abled persons. He also briefed about the technologies developed by ICAR-CSSRI and their socio-economic impact. Director of the school Dr. K. L. Dang briefly discussed the achievements of the school besides other missionary work being undertaken by the trust. He also proposed the vote of thanks and requested the Director CSSRI to organize such events in the future also for motivating the students. About 500 students and CSSRI staff participated in this function.


Dr. P.C. Sharma, Director, ICAR-CSSRI addressing the students

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48th Foundation Day of ICAR-CSSRI

ICAR-CSSRI, Karnal celebrated its 48th Foundation Day on 1st March 2017 by organizing a Foundation Day lecture delivered by Dr. K. Alagusundaram, DDG (AE), ICAR, New Delhi. Dr. Alagusundaram addressed the gathering on the subject 'Approaches for harnessing higher productivity from degraded salt affected lands'. He briefed that Indian agriculture supports 18% of world population with only 9% of world's arable land. Nearly one-third of the country's population lives below poverty line, and about 80% of our land is highly vulnerable to drought, floods and cyclones. Demand projections for food grains reveal that we may need at least 345 million tonnes in 2030, requiring almost the same rate of increase per annum but from shrinking land and water resources and aberrations in climate. Efforts made over the last four decades at ICAR-CSSRI have demonstrated that development of salt tolerant varieties is the key to enhance the economic value of the degraded lands. He appealed to the scientific community to address land degradation issues and come out with appropriate solutions for the salt-affected and waterlogged saline regions of India. On the occasion, Dr. P.C. Sharma, Director gave a brief glimpse of Institute's achievements.

Dr. K. Alagusundaram, delivering the Foundation Day Lecture

Rabi Kisan Mela organized

Rabi Kisan Mela was organized on 8th March, 2017 at ICAR-CSSRI, Karnal. Prof. Vijay Paul Sharma, Chairman, CACP, Ministry of Agriculture and Farmers Welfare was the Chief Guest. About 1400 farmers and school children attended the Mela and benefitted by visiting different ongoing research experiments. At the outset, Dr. P. C. Sharma, Director, ICAR-CSSRI welcomed the Chief Guest and the farmers and highlighted the aims of organizing this event. As the occasion coincided with the World Women's Day, over 100 women farmers were also invited to share their experiences in farming with the scientists. Free analysis of soil and water samples, exhibition of improved agricultural technologies developed by ICAR institutes, government agencies and private companies, sale of improved salt tolerant seeds of rice and other crops, and an interactive dialogue between scientists and farmers were the main attractions. Chief Guest Prof. Sharma addressed the farmers and requested them to remain in regular contact of the scientists for enhancing the farm profits. He urged the farmers of the region to adopt sustainable intensification farm practices to enhance their income while protecting the precious natural resources. He urged the farmers to gradually switch over to water and fertilizer use efficient crops including pulses and oilseeds to overcome the sustainability concerns related to rice-wheat cropping system. He advised that technological improvements, reduction in post-harvest losses, infrastructure development, climate change adaptation and strengthening of rural financial institutions are some of the critical areas requiring concerted focus for transforming agriculture into a ruminative business. Innovative farm women and other farmers were also felicitated on this occasion. Dr. R. K. Singh, Nodal Officer of Kisan Mela, proposed the vote of thanks.

Prof. Vijay Paul Sharma, Chairman, CACP addressing the farmers

Training programme for Maharashtra farmers organized

A four days training programme on 'Sustainable management of crop productivity in salt affected soils and poor quality waters' was organized for 15 farmers of Ahmednagar district of Maharashtra State from 5-8 June, 2017. Dr. A.K. Singh, DDG (Agric. Extn.), ICAR, New Delhi inaugurated the training programme. Dr. Singh appreciated the noteworthy contributions of ICAR-CSSRI in the reclamation of vast tracts of salt affected soils in different parts of the country. He emphasized that continued salinization of soil and water is a cause of concern as it causes huge crop and monetary losses in Maharashtra and other parts of the country. He advised the farmers to have regular contact with the scientists of ICAR Institutes and Krishi Vigyan Kendras located in Maharashtra and take advantage of recent schemes such as e-kisan portal

for enhancing the farm incomes. Dr. P. C. Sharma, Director, ICAR-CSSRI, Karnal explained in detail about the gypsum technology, sub-surface drainage method and salt tolerant varieties of different crops released by the Institute which have been instrumental in augmenting the productivity of over 2 Million ha salt affected area in different parts of the country. He informed that a new project for the management of problematic soils of Maharashtra state with financial assistance from the World Bank is to be initiated shortly. The farmers attending this programme brought their soil samples which were analyzed and the information was summarized in 'Soil Health Cards' subsequently handed over to the respective farmers.

Dr. A.K. Singh, DDG (Agric. Extn.) with Farmers of Maharasthra

Notable Publications

Fagodiya, R. K., Pathak, H., Kumar, A., Bhatia, A. and Jain, N. 2017. Global temperature change potential of nitrogen use in agriculture: A 50-year assessment. *Scientific Reports,* 7, doi: 10.1038/srep44928.

Lal, K., Yadav, R. K. and Minhas, P. S. 2017. Long-term sewage irrigation and fertilizer effects on carbon balance in peri-urban cropping systems. *Science of the Total Environment,* http://doi.org/10.1016/j.scitoteenv.2017.02.195

Patra, S. and Burman, D. 2017. Maintenance of storability and enhancing productivity of rice crop by seed invigoration treatments in coastal region of Sundarbans, *Vegetos* 30:1 *doi: 10.4172/2229-4473.1000216.*

Paul, N., Dhar, D., Datta, A., Saha, D. 2017. Comparative study of organic matter and humic acid on N mineralization in rice-mustard cropping sequence. *Environment & Ecology* 35:1368-1375.

Yadav, Gajender and Ellis, R.H. 2017. Effects of rain shelter or simulated rain during grain filling and maturation drying on subsequent wheat grain quality in the UK. *Journal of Agricultural Science* (Cambridge),155: 300-316

New Entrants

Dr. Priyanka Chandra, Scientist (Microbiology) 07.03.2017

Dr. Kailash Prajapat, Scientist (Agronomy): 15.03.2017

Sh. Manish Kumar, Scientist (Agro-forestry), 29.03.2017

Dr. Anil Kumar Principal Scientist (Agril. Extension), 01.06.2017

Superannuations

Dr. D.K. Sharma, Principal Scientist and Ex-Director, 31.01.2017

Sh. B.R. Sharma, Asstt., 31.01.2017

Sh. P.K. Dhar, Technical Officer,.31.01.2017

Sh. Dharam Singh, SSS, 28.02.2017

Sh. Roshan Lal Kajal, Technical Officer, 31.03.2017

Sh. Jagmer Pal,SSS, 30.04.2017

Notable Visitors

Dr. Ramesh Yadav, Chairman Haryana Kisan Aayoug

Dr. Kein Suke Omori, Sr. Scientist, Okinawa, JIR CAS, Japan

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