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SALINITY News

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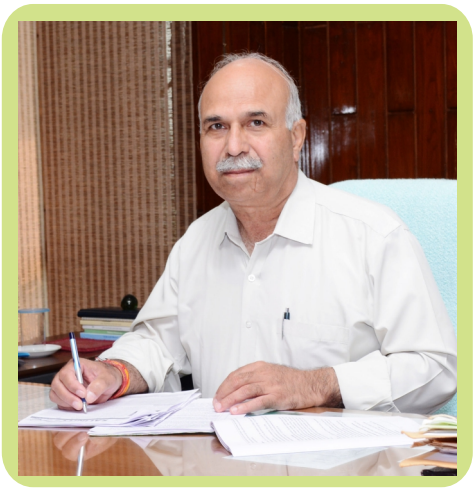
From Directors' Desk



Since its inception in 1969, ICAR-CSSRI has made immense progress in developing technologies for reclaiming the salt affected soils of the country. Gypsum technology, salt tolerant crop varieties and sub-surface drainage (SSD) technology developed by ICAR-CSSRI has made significant impact nation-wide to reduce these loses either by soil reclamation or increase in crop productivity. Despite the huge success in restoring the productivity of salt affected lands, the several constraints, such as, out-dated database of salt-affected soils and waters, limited availability of amendments, coexistence of multiple abiotic stresses, resodification of waterlogged alkali soils, and limited options for dry land salinity management have plagued the reclamation progress of salt affected soils. Therefore, present research have been focused on the identification of ameliorants and refinement of cultural practices with the aim to attain the multiple objectives- productivity, profitability, and sustainability- so as to devise appropriate policy and action programmes at the national level to achieve the sustainable development goals.

In this volume of Salinity News (July-December, 2021), the major research achievements provided are: Iron fertilization to address its deficiency under direct seeded rice on partially reclaimed sodic soils, restoring the productivity of waterlogged saline vertisols through subsurface drainage, metabolomics in unleashing the salt tolerance mechanism of Indian mustard, foliar spray of potassium nitrate, salicylic acid, and thiourea alleviates alkali water irrigation induced stress in paddy (*oryza sativa l.*), low Budget natural farming for sustainable crop production, potato planting by zero tillage with paddy straw mulching in coastal salt-affected region: a promising technology for profitable cropping system intensification, flue gas desulfurization gypsum: an emerging amendment for reclamation of sodic soils and digitization of shivri farm land-use, RRS, Lucknow. Several extension and training programs were organized during these six months such as 11th Advanced course on "conservation agriculture: gateway for productive and sustainable cropping systems", AARDO sponsored online international training programme on "sustainable agriculture in saline ecologies" , Farmers gosthi on social-ecological resilience, State level maize day, Swachhta Pakhwada and Hindi Pakhwada. Institute also organized Rabi Kisan Mela and Kisan Divas at Village Habri, District Kaithal.

(Parbodh Chander Sharma)
Director

In This Issue.....

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Iron fertilization to address its deficiency under direct seeded rice on partially reclaimed sodic soils

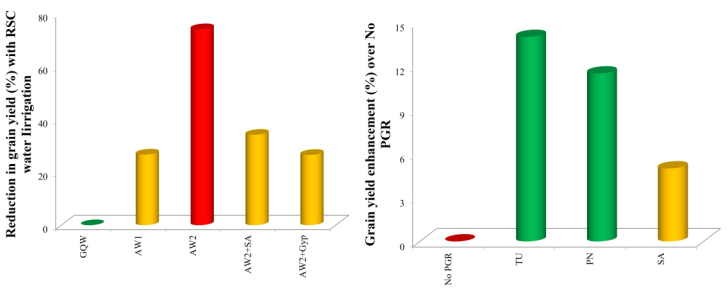
In india, direct Seeded Rice (DSR) is grown under non-puddled and non-flooded conditions. Despite of its advantages, the few constraints like weed infestation, limited rice varieties for upland condition and iron deficiency, etc. restricts its adoption by the farmers. Keeping these facts in consideration, a field experiment was conducted to address the iron deficiency of DSR with foliar and soil application of Fe sources under DSR (CSR-60) – wheat (KRL-210) cropping system in a partially reclaimed sodic soil. In case of soil application, the Fe was applied in the form of ferrous sulphate ($FeSO_4.7H_2O$) at the rate of 30, 40 and 50 kg ha^{-1} during the time of sowing, while in case of foliar application, the sprays of $FeSO_4.7H_2O$, Fe-EDTA, Fe-EDDHA and Fe-DTPA were done at 30, 45 and 60 days after sowing. The results showed that the maximum grain yield (5.42 t ha^{-1}) was recorded in foliar application of 0.2% Fe-EDDHA that was 9.58% higher than the control treatment (49.4 t ha^{-1}). The foliar application of 3% $FeSO_4.7H_2O$ solution was equally effective as 0.2% Fe-EDDHA. However, the spray of 3% FeSO4.7H2O were cost effective and increased yield by 7.85% over control, and hence is a easily acceptable and adoptable technique at the field level. Among the soil treatments, the highest grain yield (8.62 % higher over control) was recorded from 50 kg Fe ha^{-1} (i.e. 250 kg $FeSO_4.7H_2O$) which was followed by 40 kg Fe ha^{-1}. The soil application of Fe requires huge quantity of ferrous sulphate which could not be practically feasible for the farmers. Therefore, the foliar application of Fe (either through iron sulphate or iron chelate) was more effective than the soil application. Analysis of whole plant showed that ferrous-iron (Fe^{2+}) content in rice was better in case of foliar and soil application of Fe, and the Fe^{2+} content in rice plant is considered as a good indicator of iron nutrition of rice. The Fe^{2+} content in plants at 65 days after sowing was 40 mg kg^{-1} (dry weight basis), therefore, it could be considered as adequate level for rice grown under upland aerobic condition. Thus, Fe fertilization through foliar application of 3% ferrous sulphate sprays (thrice) under DSR on partially reclaimed sodic soils is recommended to address iron deficiency and improve rice yield.

DSR under foliar application of 3.0% ferrous sulphate solution

BL Meena, MJ Kaledhonkar, RK Fagodiya, RL Meena and PC Sharma

Foliar Spray of potassium nitrate, salicylic acid, and thiourea alleviates alkali water irrigation induced stress in paddy (Oryza sativa L.)

Foliar spraying of plant growth regulators was tested to assess the growth, physiological attributes, and yield of paddy crop under alkali water irrigation conditions. The paddy crop was grown under long-term alkali water irrigation conditions and continuously supplied with different levels of residual alkalinity waters i.e. RSC 5 and 10 me L^{-1}, and latter (10 me L^{-1}) were neutralized to RSC equivalent to 5 meL^{-1} with either gypsum or sulfuric acid. Application of different alkalinity irrigation water resulted in a reduction in paddy yield to the extent of 17-48 and 34-100% during 1st and 2nd year, respectively. Each different water irrigated plot was further divided into four equal parts for assessing the sodicity stress alleviating efficacy of different plant growth regulators. Plant growth regulators viz., thiourea 500ppm, potassium nitrate 15g L^{-1} and combinations of thiourea + potassium nitrate were applied during 1st year; however, combination of thiourea + potassium nitrate was replaced with salicylic acid (10uM) in 2nd year. These plant growth regulators were sprayed 4 times (at tillering, maximum growth, panicle initiation to grain formation and two days after 3rd spray) on paddy. The foliar spraying of thiourea, potassium nitrate, and thiourea + potassium nitrate resulted in the increased paddy grain yield by 13, 11 and 12% in 1st year and 5-14% in 2nd year. Moreover, spraying of these growth regulators have been observed to improve the various physiological attributes -SPAD values, photosynthetic rate, proline, malondialdehyde, membrane injury and relative water content in paddy crop. Present study suggests the effectiveness of foliar spray of plant growth regulators in improving the plant physiological processes and their prudence in enhancing paddy yield under alkali groundwater irrigation induced sodicity stress conditions.



Effect of different growth regulators on the grain yield of paddy

Awtar Singh, Aradhana Bali, Ashwani Kumar, RK Yadav and Paramjit Singh Minhas

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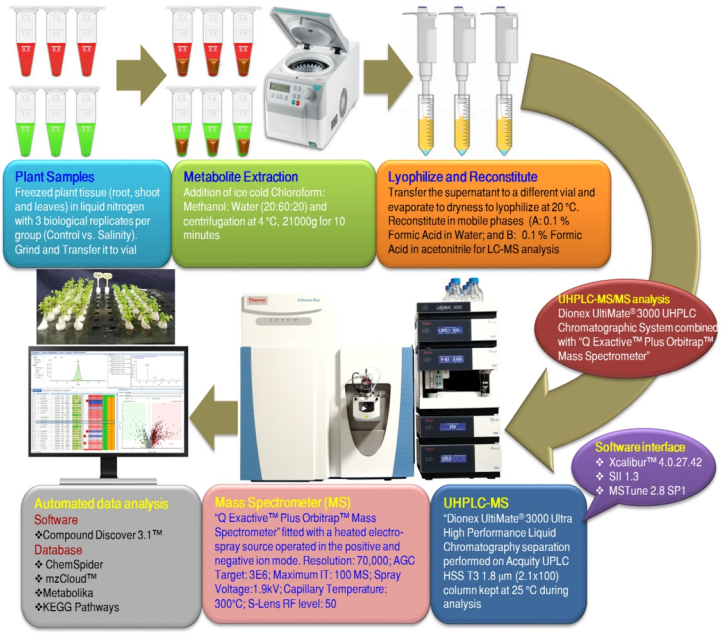
Metabolomics in unleashing the salt tolerance mechanism of Indian Mustard

Metabolomics involves identification and quantification of metabolites and chemical footprints of cellular regulatory processes in different biological species. Metabolomics plays a significant role in exploring environment–gene interactions, phenotyping, identification of biomarkers, and decipher various metabolic networks that are linked with biotic and abiotic stress tolerance in plants. In this context, we explored the global metabolomic response of two Indian mustard genotypes- CS 60 (salt tolerant) and CS 245-2-80-7 (salt sensitive)- grown under salt stress for variable time periods to unleash the role of differentially accumulated metabolites and relevant metabolic pathways involved in the salt tolerance mechanism. A total of 608 known compounds were detected from 4119 metabolites using *Dionex UltiMate® 3000 Ultra High-Performance Liquid Chromatographic System* combined with "*Q Exactive™ Plus Orbitrap™ Mass Spectrometer* (UHPLC-MS/MS) analysis, from which 111 significantly altered metabolites in both genotypes were selected based on t-test and VIP score values. Mustard genotype CS 60 and CS 245-2-80-7 exhibited 63 and 48 differentially accumulated metabolites (DAMs), indicating metabolic alteration induced by salinity stress. The DAMs were majorly grouped in organic acids followed by nucleotide derivatives, amino acid derivatives, and aldehydes. Using *MetPa* from *Metabo Analyst 5.0* platform, a total of 51 metabolic pathways with significant impact values were observed to be involved in the salt tolerance mechanism in Indian Mustard. We detected 34 and 17 potentially relevant metabolic pathways in CS 60 and CS 245-2-80-7 during two different time points (24h and 72h) of salt stress. In CS 60, mainly pentose phosphate pathway, cutin, suberin and wax biosynthesis, carbon fixation in photosynthetic organisms, glycolysis/gluconeogenesis, fructose and mannose metabolism, pyrimidine metabolism, folate biosynthesis, cysteine and methionine metabolism, and one carbon pool by folate were found consistent throughout the salt stress thus regulating the salt tolerance mechanism. Contrastingly, CS 245-2-80-7 exhibited only arginine biosynthesis pathway during the salt stress, accounting



Metabolic pathway involved in salt tolerance mechanism in Indian Mustard

for its low response towards salt stress. Additionally, both the genotypes shared nine common relevant metabolic pathways (folate biosynthesis, glutathione metabolism, histidine metabolism, terpenoid backbone biosynthesis, ubiquinone and terpenoid-quinone biosynthesis, brassinosteroid biosynthesis, cutin, suberin and wax biosynthesis, nicotinate and nicotinamide metabolism, and pyrimidine metabolism) under salt stress. Increased accumulation of metabolites and detected relevant pathways majorly regulating the anti-oxidant defense system gives CS 60 (a high yielding variety) an edge against the genotype CS 245-2-80-7, which might be the major tolerance mechanism to withstand and higher salt stress. Overall, our study unravels the dynamics of metabolic understanding of *Brassica juncea* under salt stress which will provide valuable information on *Brassica* to develop new salt tolerant high yielding varieties.

Jogendra Singh, Vijayata Singh, Vikas Dutt, Nisha Walia, Gayatri Kumawat, ML Jakhar, DK Yadava and PC Sharma

Flue gas desulfurization gypsum: An emerging amendment for reclamation of sodic soils

Flue gas desulfurization gypsum (FGDG) is a by-product of scrubbing sulphur from combustion gases in coal-fired power generation plants. FGDG (calcium sulfate dihydrate, $CaSO_4 2H_2O$) has become widely available as a byproduct of forced-oxidation wet scrubbers that are used to reduce sulfur emissions (SO_x) from coal-fired power plants using a spray of limestone slurry. Applications of FGDG in cultivated soil improve physicochemical properties, decline nutrients loss, supplement nutrients for soil and improve crop yield; thereby increasing the overall productivity. FGDG widely used in building materials (such as wallboard, plaster coatings, and concrete), and also has the potential to reclaim sodic soils as an alternative to mined gypsum presently being used. Recognizing the role of FGDG in the reclamation of sodic soil as an alternative to mine gypsum, CSSRI and NTPC have jointly initiated a collaborative project to study the efficiency and efficacy of FGDG in the reclamation of sodic soils and monitoring of the heavy metal(s) uptake, crop growth and quality of soil and leachates in FGDG amended soils. An experiment on reclamation of sodic soils with the application of FGD gypsum is being carried out in the lysimeters with sodic soils

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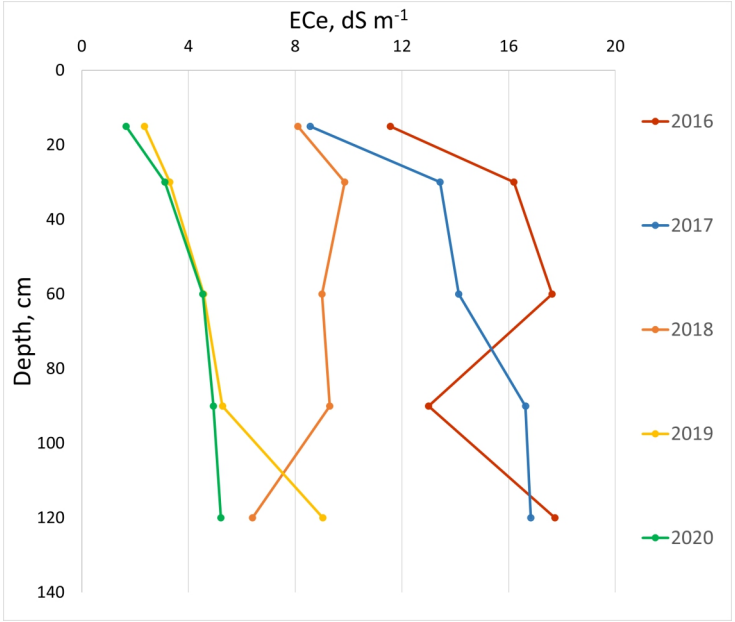
brought from four locations having varying pH. Results showed that the soil pH_s declined by 8-11 percent after one year of application of FGDG/gypsum in sodic soil at 0-15 cm depth under experimental conditions at ICAR-CSSRI. Similarly, a significant change in pH_s was observed at 15-30 cm depth. The decrease in soil sodicity and neutralization of soil alkalinity over the period has improved paddy growth and yield. The paddy grain yield increased by 30-50 percent with FGDG/gypsum application compared to unamended control. The wheat grain yield increased by 50-80 with the application of FGDG/gypsum in sodic soil. The harvest index of wheat was significantly higher in soils treated with different doses of FGDG (0.44-0.47) compared to control (0.37). The application of FGDG for reclamation of the sodic soils of different regions of the country viz., Haryana, Uttar Pradesh, and Punjab have been executed from *kharif* season (2021) through participation experiments. The results of this study can serve as a practical guide for availability of alternative source for soil amendment. Both economic and environmental benefits can be obtained *via* optimized application rates and considerable benefit to the improvement of sodic ecosystems.

Sodicity reclamation experiment using FGDG at CSSRI, Karnal

Parul Sundha, Nirmalendu Basak, AK Rai, Raj Mukhopadhyay, RK Yadav and PC Sharma

Restoring the productivity of waterlogged saline Vertisols through subsurface drainage

Vertisols are famous for their productivity; however, excess irrigation and inadequate drainage lead to severe problems of land degradation. The Ukai kakrapar canal command area of Gujarat is facing twin problems of secondary soil salinization and waterlogging and it is a serious threat to sugarcane cultivation in the region. One such site is Adadara village of Bharuch district which consists of highly saline waterlogged soil (EC_e more than 10 dS m^{-1} in all soil layers) was chosen for installation of sub-surface drainage (SSD) system with the objective to reduce soil salinity and improve crop productivity. Prior to SSD installation, the village farmers had literally abandoned sugarcane cultivation due to very low crop yield (~25 t/ha) as a result of poor soil conditions. The SSD was installed in the month of February 2017 with a lateral spacing of 35 m, and the data pertaining to soil, water and crop was collected at the regular intervals. Analysis of data showed a drastic reduction in the soil salinity (up to 86%) post-SSD installation (figure). The soil electrical conductivity (EC_e) showed declining trends which was observed to be < 4 dS m^{-1} in surface layer (0-30 cm) and 4 to 5.2 dS m^{-1} in subsurface layers (30-120 cm). This improvement in soil salinity was mainly attributed to the timely efforts of farmers to ensure proper drainage outflow from the sump. Forage crop was cultivated immediately after SSD installation and with subsequently decrease in soil salinity, it was possible to grow with significantly higher yield (75-80 t ha^{-1}). Moreover, the improvement in water table (below 1 meter) was observed which was earlier waterlogged. Overall, successful operation of SSD system for 4 years led to effective desalinization of the soil profile, and hence it improved soil quality, crop productivity, and farm income.



Depth wise temporal variation in soil salinity at Adadara SSD site

Sagar D. Vibhute, Anil R. Chinchmalatpure, M. J. Kaledhonkar, Monika Shukla and Vineeth T. V

Potato planting by zero tillage with paddy straw mulching in coastal salt-affected region: A promising technology for profitable cropping system intensification

Inherent soil and water salinity and irrigation water scarcity in Costal Saline Zone (CSZ) of India are impediment to successful crop cultivation. To cope up with these constraints, introduction of technology which favours conservation of soil moisture, suppresses upward movement of salts in soil profile and emphasizes on water saving options. Mono-cropped coastal saline soils can be converted into multiple cropping through the potato zero tillage cultivation combined with straw mulching (PZTM). This practice allows potato (cv. *Kufri Pukhraj*) tuber planting in the wet field just after the harvesting of the preceding monsoon or *kharif* rice. The seed tubers were covered with farm yard manure (FYM) @ 5 t ha^{-1}, and then basal NPK fertilizer (10-26-26), urea and SSP are applied. The

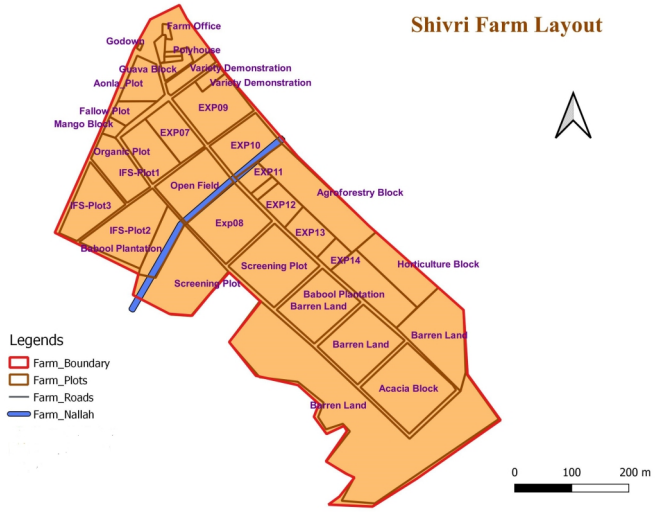
FYM and basal fertilizers are then covered by a thick layer (20 cm ≈ 12 tha^{-1}) of paddy straw. Foliar spray (10 g L^{-1}) of water-soluble compound fertilizer such as 19-19-19 kg N-P_2O_5-K_2O were given at 30 and 45 days after planting (DAP). Third foliar spray (2 g L^{-1}) were given at 60 DAP with 13-0-45 kg N-P_2O_5-K_2O for better tuber growth. Due to conservation of soil moisture, less number of (3-4) irrigations are required under PZTM technology, compared to conventional cultivation practices (about 6 numbers). During the *Rabi* 2020-21, the potato tuber yield under ridge and furrow cultivation was 14.5 t ha^{-1} whereas under PZTM with 30 ×15 cm spacing and 12 t ha^{-1} mulching, the tuber yield was 23.3 t ha^{-1}. The rice equivalent yield (REY) of rice-potato and rice-potato-green gram cropping systems under conventional practice was 10.78 and 12.36 t ha^{-1} respectively. Whereas, under PZTM, the respective REY was 15.05 and 17.63 t ha^{-1}. The net return could be increased from ₹ 34,186 ha^{-1} under conventional cropping system (Rice-fallow), to ₹ 136243 ha^{-1} with adoption of Rice-PZTM system and further to ₹ 153150 ha^{-1} by Rice-PZTM-green gram system. The benefit cost ratio of Rice-potato system in CSZ can be increased from 1.31 under conventional cultivation method to 1.93 under Rice-PZTM.

Potato cultivation following ZT planting and paddy straw mulching in coastal saline soils

Sukanta K. Sarangi, S. Raut, U. K. Mandal and K. K. Mahanta

Digitization of Shivri Farm Land-use, RRS, Lucknow

CSSRI-Regional Research Station, Lucknow has an experimental farm at Shivri, which is located between 26.7965 – 26.8044° N latitude, 80.7669 – 80.7748° E longitude. Shivri farm has been digitzed using QGIS, an open source GIS software (Hannover, v 3.16) and GPS points were collected from the farm boundary. Farm features such as boundary, experimental/ field plots and roads have been digitized. According to the digitized maps, the perimeter and area of the Shivri farm were recorded to be 2825.48 m and 27.75 ha, respectively. Total 34 field plots including farm office, polyhouse, variety demonstration, screening plots, tree plantations, etc. have been demarcated and digitized. The map was generated using QGIS digitization tools at 1:5400 scale and the prepared layout map can be used for planning the research and development activities.



Shivri farm layout map created in QGIS software

R.H. Rizvi, T. Damodaran, Arjun Singh, Shyamji Mishra and Dipak Ojha

Low Budget natural farming for sustainable crop production

Natural farming' emphasizes the importance of co-production of crops relying on easily available 'inputs' to build up soil fertility and microbial population. The approach is built on the 'four wheels': (1) stimulation of microbial activity to make nutrients available to plants and protection against pathogens using a microbial inoculum, *jiwamrita*; (2) supply of plant nutrients through organic fertilizer prepared using 'indigenous' cow dung, cow urine, jaggery, and pulse meal, *ghanajiwamrit*; (3) production of stabilized soil organic matter and conservation of top-soil by mulching '*acchadana*' and (4) soil aeration ('*whapahasa*') by improving soil structure and reducing tillage. Hence, we formulated the field experiment for comparing the conventional farming (chemical inputs) system with LBNF treatments in order to evaluate agricultural sustainability of natural farming under irrigated agro ecosystem of India. A field experiment was conducted with seven treatments and three replications in RBD under rice-wheat cropping system (RWCS) at Research farm of ICAR-CSSRI, Karnal. Rice variety: basmati rice (var: CSR-30) and wheat salt-tolerant variety (var: KRL-210) and maize hybrid variety (Pioneer 3378) were used. The treatments were: (i) Scenario (Sc-1): R(rice)-W(wheat)- F(Fallow) with conventional tillage (CT) and without residue retention, and 100% N through chemical fertilizers, (ii) Sc-2: Transplanted Rice (TPR) - zero tillage wheat (ZTW) – zero tillage dhainca (ZTD) with full residue retention and 100% N through

chemical fertilizers, (iii) Sc-3: Same as Sc-2 with 100% N through farm yard manure (FYM)/vermicompost, (iv) Sc-4: Same as Sc-2 with 50% N through FYM/vermicompost and 50% N through chemical fertilizers, (v) Sc-5: Same as Sc-2 and nutrients source through LBNF components, (vi) Sc-6: zero tillage rice (ZTR)- ZTW- ZTD with full residue retention and nutrients source through LBNF components, and (vii) Sc-7: Maize (CT)- ZTW- ZTD with full residue retention and nutrients source through LBNF components. The experimental results for *kharif* season (rice and maize) suggested that the grain yield under Sc-1, 2, 3 and 4 was at par and ranged between 37.60 to 40.27 q ha^{-1}. However, under Sc-5, Sc-6 and Sc-7 of LBNF components grain yield lowered significantly by 26, 57 and 47%, respectively as compared to conventional R-W system (Sc-1). Under Sc-7 the maize yield was converted to rice equivalent yield (REY).

Experimental view of different scenarios of LBNF project at Research Farm of ICAR-CSSRI, Karnal

PC Sharma, Raj Mukhopadhyay, R.K. Fagodiya, Awtar Singh and HS Jat

11th Advanced course on "Conservation Agriculture: Gateway for productive and sustainable cropping systems"

The two-week advanced course on "Conservation Agriculture: gateway for productive and sustainable cropping systems" was organized at ICAR-CSSRI, Karnal and Borlaug Institute for South Asia (BISA), Ludhiana, India, from 6th December to 19 December, 2021. The course was jointly organized by the CIMMYT, ICAR-CSSRI and BISA with the support from Indian Council of Agricultural Research, CGIAR Research Program on WHEAT, Maize and CCAFS. Agricultural professionals from multi-disciplines like agronomy, soil science, engineering, plant breeding and plant pathology belonging to different states of India participated in the training programme. The duration of the course was intended to seek knowledge dissemination on various topics from across the disciplines like engineering, agriculture practices, remote sensing, economics, communication, etc. The major emphasis was given on imparting hands-on-training to the participants in addition to the operation of farm machinery, crop diversification, and management of water, pest, weed, residue, soil, and irrigation. The resource persons from various disciplines-Dr. HS Jat, Dr. HS Sidhu, Dr. Yadvinder Singh, Dr. Mahesh Gathala, Dr. Rajbir Singh, Dr. RK Jat, Dr. CM Parihar, Dr. Manpreet Singh, Dr. Madhu Choudhary, Dr. Debashish Chakarborty, Dr. YS Saharawat, Dr. Satyander Kumar, Dr. RS Chhokar, Dr. Saroj Jaipal, Dr. Uttam Kumar, Dr. S Atwal, Dr. Sujay Rakshit, Dr. Balwinder Singh, Dr. Santiago Lopez Ridaura, Dr. Hom, Dr. Vijesh Krishna, Dr. Tek Sapkota and Dr. ML Jat- delivered lectures during the training program. The main objective of the training was to impart the theoretical knowledge and practical experience in the field of conservation agriculture. During the closing ceremony, Dr. SK Chaudhary, DDG, NRM provided an insight into the importance of conservation agriculture in the present scenarios. Dr. PC Sharma, Director, CSSRI along with Dr. ML Jat, Dr. RK Yadav, and Dr. HS Jat interacted with participants and distributed certificates on completion to the training programme.

Demonstration of conservation practices to the trainees

AARDO sponsored online international training programme on "Sustainable Agriculture in Saline Ecologies"

An online international capacity building programme on "Sustainable Agriculture in Saline Ecologies" was organized by African-Asian Rural Development Organization (AARDO) at ICAR-Central Soil Salinity Research Institute (CSSRI), Karnal, India during during 20 to 29 September 2021. In this programme, 58 delegates from eighteen (18) AARDO member countries namely, Bangladesh, R.O. China (Taiwan), Egypt, Ghana, R.O. Korea, Malaysia, Mauritius, Morocco, Namibia, Nigeria, Oman, Pakistan, Palestine, Sri Lanka, Sudan, Syria, Tunisia and Zambia participated. The programme was inaugurated by Dr. S. K. Chaudhari, Deputy Director General, Natural Resource Management, ICAR New Delhi and presided over by Dr Prabodh

Chander Sharma, Director, ICAR-CSSRI, Karnal. The programme comprised of plenary sessions of presentations on various issues of sustainable management of salinity and use of poor quality water in agriculture to apprise the delegates on parameters of salinity, poor quality water and their management issues. During programme, the various topics on soil, water, crop, and trees aspect were covered in relation to the use of poor quality water. During valedictory function, Dr Khushnood Ali, Head, Research Division & Programme Coordinator, AARDO was Chief Guest. He highlighted the need of sustainable management of salt affected ecologies and use of saline water for irrigation in agriculture in AARDO member countries and the relevance of this Capacity Building programme for these countries.

Program Banner

Farmers gosthi on social-ecological resilience

The salinity induced land degradation has been one of the major issues affceting 6.73 M ha lands in India. Considering this issue, ICAR-CSSRI, Karnal started a grassroot work with farmers of Begampur village (Karnal) for past ~ 4 years to make them aware them about sustainable agroecological practices and enabling policies, including Land Degradation Neutrality (LDN), to enhance social-ecological resilience at the community-scale. To pursue such practices, a farmers Goshthi was organized on 22nd October, 2021 with participation of 70 women and men farmers to provide them technologies supports (salt wheat variety KRL-210 and organic fertilizers), share the knowledge on crop diversification programmes, and enhancing social-ecological resilience. On this occasion, Dr. P.C. Sharma, Director, ICAR-CSSRI, Karnal encouraged farmers to adopt sustainable agroecological practices developed by ICAR-CSSRI to manage multiple stresses. He also appraised the initiative taken-up by village Panchayat in association with ICAR-CSSRI, Karnal, local NGO and State Department of Agriculture on various practices (community scale sodicity and rice residue management, farm diversification, etc.) to enhance social (access of knowledge and skill) and ecological (soil health and water conservation) resilience. On this occasion, seed of salt tolerant wheat (KRL-210), biofertilizers, and animal mineral mixture were provided to 62 farmers.

Farmers' participation in Kisan Gosthi

State Level Maize Day

ICAR-CSSRI celebrated Haryana Maize Day on 11 September in collaboration with CIMMYT, ICAR-IIMR, CCHAU, Hisar, Department of agriculture, Govt. of Haryana, and Krishi Vigyan Kendras (KVKs). One state level and two district level farmers field days on maize-based systems were organized at Ambala, Kurukshetra and Karnal districts. It was observed that increasing farmers knowledge and skill through result demonstrations and farmer-to-farmer cross learning is an effective way towards mass scale adoption of crop diversification in rice-wheat cropping system. Exposing farmers to the demonstrations sites was found to be best to build confidence among the farmers on such practice. A total of 500 innovative farmers, service providers, agriculture officers, from Agriculture Department, CCHAU and KVKs participated in the events.

Dr ML Jat, CIMMYT coordinator, India addressing farmers and stakeholders during the Haryana Maize Day

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Swachhta Pakhwada 2021

ICAR-Central Soil Salinity Research Institute, Karnal celebrated the 'Swachhta Pakhwada' from 16 to 31 December, 2021. As per the programme, each day different activities were carried out in ICAR-CSSRI campus, adopted villages under MGMG programme, public places, and nearby villages. Under the theme 'Wealth from waste', the different activities, such as, awareness of waste management and composting of kitchen waste programme were organised for the common people and farmer`s community.

Swachhta Pakhwada 2021

Hindi Pakhwada 2021

Hindi Pakhwada was organized at ICAR-CSSRI Karnal from 14th to 28th September 2021. The various events and competitions, such as, speech, essay writing, etc. were organized to promote the use of Hindi language during day-to-day work. Prof. Radhey Shyam Sharma, Vice Chancellor, GJUST, Hisar was chief guest for the closing ceremony of Hindi Pakhwada. In his address, he emphasized on the importance of Hindi language, and also stressed on the need to promote Hindi language among the school kids. He appreciated the institute's dedication and efforts towards promoting the use of Hindi language.

Prof. Radhey Shyam Sharma addressing the audience

Rabi Kisan Mela and Kisan Divas at Habri

The institute organized *a Rabi* Kisan Mela at village Habri, District Kaithal, Haryana on 05 October 2021. Dr. Gurbachan Singh, Former Chairman ASRB, New Delhi graced the Mela as Chief Guest. This mela was attended by about 250 farmers of the nearby villages. About 25 exhibition stalls showcasing latest technologies were present, farmers were also distributed seeds of salt tolerant crop varieties. During this day, lectures on improved agro-techniques for salt affected soil and poor quality irrigation delivered by subject matter specialist of institute and invited speakers of other institutes. A general knowledge quiz on agriculture related aspects was also conducted in the Mela. The institute also organized "Kisan Divas" in Habri on 23 December 2021. In this programme, participating farmers were given advisories on management salt affected soils and poor quality irrigation water, crop management of wheat, chick pea and mustard, weed control in wheat and pest and disease control in wheat crop by institute scientists. The queries of farmers were also responded by the scientists. The participating farmers were also sensitized about S*wachhata* mission and agricultural waste management. The progressive farmers of MGMG adopted villages of Haryana and Punjab were felicitated on this occasion. The programme was attended by about 100 farmers of the nearby villages.

Glimpse of Kisan Divas at Habri village

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