

GSAS21 Scientific Poster Contest

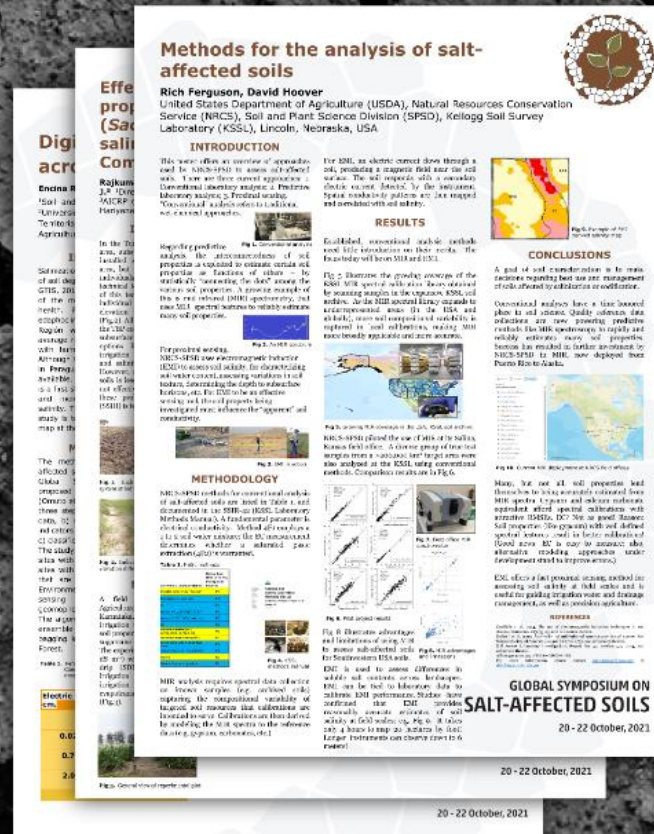


✓ Poster contest launched at the opening session (20th October)

✓ 57 posters opened for vote

✓ 58 posters prepared out of the 220 abstracts received

... And the winners are:



GCAS21 Scientific Poster Contest



Sustainable rehabilitation, bridging yield gaps and increasing farmers' income in salt affected rice-wheat agroecosystems: A farmers' participatory assessment

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INTRODUCTION

With shrinking land resources, sustainable restoration of degraded lands is vital to ensure food security and address livelihood concerns in arid and semi-arid regions worldwide. Continuous use of bicarbonate dominated poor quality water results in the build-up of sodium saturated soil conditions and dispersion of clay particles causing soil sodicity/salininity problems and negatively impacting agricultural productivity. To improve current understanding and address crop production, it is imperative to assess the farmers' traditional salinity management strategies and also develop a climate resilient integrated soil-crop management system to harness the potential of salt-affected soils.

METHODOLOGY

The present study focuses on small-scale production systems in sodicity-affected Gharigar basin of Karnal district in Haryana (India) where input-intensive, highly mechanized rice-wheat rotation is followed for more than two decades (Figure 1). Five villages adopted under CSSRI Farmer FISTP Project were purposively selected on account of prevalence of sodic soils (40% area; soil pH=8.5) and high residual salinity in groundwater (SO₄ area; RSC_{eq}>2.5 me L⁻¹) (Fig. 1).

RESULTS

- Sodic soils amelioration with Gypsum+PS, accelerated the reclamation process. Improved plants salt tolerance and enhanced rice-wheat system performance by 25% compared to unamended control and by 5% over G₂.
- Cumulative yield model revealed genotypic variation in requirements attaining economic outputs at 90 kg ha⁻¹ in CSRI30 Basmati, 140 kg ha⁻¹ in PB1211, 173 kg ha⁻¹ in HRL2110 and 188 kg ha⁻¹ in HD 2967.
- Translating rice using 2 seedlings m⁻² at 20 × 15 cm spacing, managing multiple resistance in *Phalaris minor* through sequential herbicides and foliar N-nutrition in wheat maximized opportunities for optimal resource-use and sustainably enhance yields and profit margins compared to farmers' practice of randomly transplanting one seedling m⁻². Soil dependency on post-emergence herbicides and ignorance to foliar N-fertilizers.
- Integrated approach involving gypsum and pre-monsoon-mediated sodic land reclamation, use of stress tolerant varieties and crop-specific agronomic manipulations (denser planting, balanced nutrition, effective weed control) in rice-wheat system displayed appreciable reductions in soil sodification, improved plant physiological and growth traits, and enhanced system yields, profit margins and benefits cost ratio (Rs 24.1 ha⁻¹, 2103 US\$ ha⁻¹ and 3.22) in comparison to existing recommendations (7.88 t ha⁻¹, 1943 US\$ ha⁻¹ & 3.05) and farmers' practices (6.63 t ha⁻¹, 1503 US\$ ha⁻¹ & 2.80), respectively.

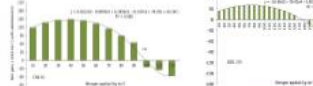


Fig. 1. Map and location of study area in the Gharigar basin of Karnal district, Haryana, India.

Parameter	FPs	FPs	FPs
Area (ha)	2.80	3.30	3.30
Area (km ²)	3.37	3.37	3.37
Rice-wheat system	6.63	7.88	6.29
Baseline indicator			
Residual soil (kg ha ⁻¹)	420	437	438
Residual soil (kg ha ⁻¹)	940	960	961
Soil pH (0-10 cm)	13.02	13.02	13.02

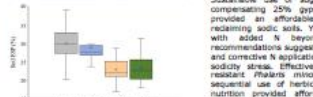


Fig. 2. Effect of gypsum and PS on the residual soil (kg ha⁻¹) for different treatments.

Treatment	Yield (t ha ⁻¹)	Profit (US\$ ha ⁻¹)	Benefit:Cost Ratio
T1 (Unamended Control)	6.63	1503	2.80
T2 (Gypsum)	7.88	1943	3.05
T3 (PS)	6.63	1503	2.80
T4 (Gypsum + PS)	9.40	2410	3.22
T5 (Gypsum + PS + N)	9.40	2410	3.22

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Fig. 3. Effect of gypsum and PS on the residual soil (kg ha⁻¹) for different treatments.

Global Symposium on
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20-22 October 2021

ICAR-Central Soil Salinity Research Institute, Karnal, INDIA

Effect of irrigation management on soil properties, growth and yield of sugarcane (*Saccharum officinarum*) in waterlogged saline Vertisols under Tungabhadra Project Command area

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INTRODUCTION

In the Tungabhadra project command (TBP) area, subsurface drainage systems are being installed to reduce waterlogging and salinity stress, but due to higher investment cost for individuals per unit area (Fig. 1) and very poor technical knowledge on installation, adoption of this technology taking a back seat. Some individual farmers do not have the required elevation difference with natural drainage (Fig. 2). All the waterlogged and saline soils of the TBP command cannot be brought under the subsurface drainage system. Instead, soft options like surface or subsurface drip irrigation technology under the waterlogged and saline soils could be a better option. However, surface drip irrigation under saline soils is less effective as the water applied may not effectively reach down soils. To overcome these problems, subsurface drip irrigation (SDI) is tested in saline soils.



Fig. 1. Map showing the location of the study area in the Tungabhadra project command area.

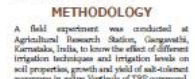


Fig. 2. Photograph showing the installation of subsurface drip irrigation system in a field.

METHODOLOGY

A field experiment was conducted at Agricultural Research Station, Gangavathi, Karnataka, India, to know the effect of different irrigation techniques and irrigation levels on soil properties, growth and yield of sugarcane in saline Vertisols of TBP command. The experiment was laid out in a split-plot design with 16 treatments and 3 replicates. The treatments were: (i) SDI, (ii) SDI + N, (iii) SDI + P, (iv) SDI + K, (v) SDI + N + P, (vi) SDI + N + P + K, (vii) SDI + N + P + K + Zn, (viii) SDI + N + P + K + Zn + S, (ix) SDI + N + P + K + Zn + S + Cu, (x) SDI + N + P + K + Zn + S + Cu + B, (xi) SDI + N + P + K + Zn + S + Cu + B + Mo, (xii) SDI + N + P + K + Zn + S + Cu + B + Mo + Fe, (xiii) SDI + N + P + K + Zn + S + Cu + B + Mo + Fe + Mn, (xiv) SDI + N + P + K + Zn + S + Cu + B + Mo + Fe + Mn + Co, (xv) SDI + N + P + K + Zn + S + Cu + B + Mo + Fe + Mn + Co + Ni, (xvi) SDI + N + P + K + Zn + S + Cu + B + Mo + Fe + Mn + Co + Ni + Se.



Fig. 3. Effect of different irrigation techniques and irrigation levels on the yield of sugarcane.

RESULTS

Higher moisture was retained (Fig. 4) and more salt leached out from the root zone in (Fig. 4) and (i) subsurface drip irrigation with 1.5 ET level treatments and water table was deeper (Wang et al., 2011) and higher moisture was retained in it at deeper depths (Qin et al., 2017) with higher EC ratio (Fig. 4).

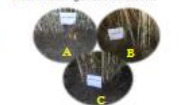


Fig. 4. Effect of different irrigation techniques and irrigation levels on the moisture content of the soil.

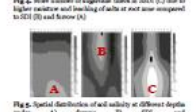


Fig. 5. Photograph showing the growth of sugarcane plants under different irrigation treatments.



Fig. 6. Effect of different irrigation techniques and irrigation levels on the yield of sugarcane.

DISCUSSION

Subsurface drip irrigation with 1.5 ET level treatments in saline recorded higher soil yield due higher salt leaching and lowering of water table (Wang et al., 2011) and higher moisture was retained in it at deeper depths (Qin et al., 2017) with higher EC ratio (Fig. 4).



Fig. 7. Effect of different irrigation techniques and irrigation levels on the yield of sugarcane.



Fig. 8. Photograph showing the growth of sugarcane plants under different irrigation treatments.



Fig. 9. Effect of different irrigation techniques and irrigation levels on the yield of sugarcane.

Improved subsurface drip irrigation technique with 1.5 ET regime had contributed to better performance of the crop under saline soils. Hence, this practice can be considered as a viable option to improve the crop productivity of sugarcane in the TBP command and could be an option for replacing drainage system.

Acknowledgements
We express our sincere gratitude to ICAR-CSSRI, Karnal, Haryana (ICAR), India for funding and giving financial support.

GLOBAL SYMPOSIUM ON
SALT-AFFECTED SOILS

20-22 October, 2021

Integrated use organic and inorganic amendments for management of calcareous sodic soils in eastern India

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INTRODUCTION

In Bihar, a state of India, out of total quality lands of rice and wheat was recorded in all the treatments over control (no amendment). The mean grain yield of rice increased from 35.2 × 35.9 t ha⁻¹ under control and treatments received Gypsum 84 t ha⁻¹ + Pre-monsoon 80 t ha⁻¹ + Chitradra, respectively. The mean grain yield of wheat, varied from 12.2 to 42.4 t ha⁻¹. The increase in grain yield treated with amendments was significantly higher under all treatments over control (Table 1). The application of different treatment increased the yield as well as improved the economic condition of farmers. The benefit:cost ratio after two cropping cycle was recorded highest in treatment T₅ (2.50) followed by T₄ (2.40), T₃ (2.30), T₂ (2.20) and T₁ (2.10).



Fig. 1. Map showing the location of the study area in the eastern part of India.

METHODOLOGY

A field experiment was conducted in calcareous soils in farmers' field of Bihar (eastern India). The different treatments T₁ - Control, T₂ - 50% of G₂ (Gypsum requirement), T₃ - Substitution Pre-monsoon 80 t ha⁻¹ + Chitradra, T₄ - 50% of G₂ + PM 80 t ha⁻¹ + Chitradra, T₅ - 50% of G₂ + Chitradra and T₆ - 50% of G₂ + PM 80 t ha⁻¹ + Chitradra were applied in randomized block design. After application, amendments were mixed in surface soil and fields were irrigated for leaching the salts followed by Chitradra cultivation (Fig. 2). In all treatments, recommended dose of fertilizers were applied as per the crop requirement. The sub-soil (0-10 cm) was tested as first crop to grow after reclamation of soils. The wheat crop (HD 2967) was sown after harvest of rice.



Fig. 2. Photograph showing the growth of sugarcane plants under different irrigation treatments.



Fig. 3. Effect of different irrigation techniques and irrigation levels on the yield of sugarcane.

RESULTS

Significant increase in the grain and straw yield of rice and wheat was recorded in all the treatments over control (no amendment). The mean grain yield of rice increased from 35.2 × 35.9 t ha⁻¹ under control and treatments received Gypsum 84 t ha⁻¹ + Pre-monsoon 80 t ha⁻¹ + Chitradra, respectively. The mean grain yield of wheat, varied from 12.2 to 42.4 t ha⁻¹. The increase in grain yield treated with amendments was significantly higher under all treatments over control (Table 1). The application of different treatment increased the yield as well as improved the economic condition of farmers. The benefit:cost ratio after two cropping cycle was recorded highest in treatment T₅ (2.50) followed by T₄ (2.40), T₃ (2.30), T₂ (2.20) and T₁ (2.10).

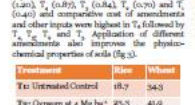


Fig. 4. Effect of different irrigation techniques and irrigation levels on the yield of sugarcane.

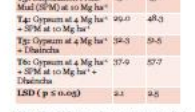


Fig. 5. Photograph showing the growth of sugarcane plants under different irrigation treatments.



Fig. 6. Effect of different irrigation techniques and irrigation levels on the yield of sugarcane.

Application of the chemical amendments i.e., gypsum gave more pronounced result in increasing grain and straw yield of both rice and wheat as well as soil properties in presence of organic manure. The present study indicates that the calcareous soils could be managed with the alternate source of amendment i.e., gypsum which is also economical for the farmers. The integrated application of gypsum (84 t ha⁻¹) along with 80 t ha⁻¹ of PM and Chitradra was found the best management practice for reclamation of calcareous soils in Bihar (eastern India).

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CONCLUSIONS

Application of the chemical amendments i.e., gypsum gave more pronounced result in increasing grain and straw yield of both rice and wheat as well as soil properties in presence of organic manure. The present study indicates that the calcareous soils could be managed with the alternate source of amendment i.e., gypsum which is also economical for the farmers. The integrated application of gypsum (84 t ha⁻¹) along with 80 t ha⁻¹ of PM and Chitradra was found the best management practice for reclamation of calcareous soils in Bihar (eastern India).



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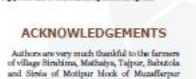


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GLOBAL SYMPOSIUM ON
SALT-AFFECTED SOILS

20-22 October, 2021

4545 VOTES

4097 VOTES

3132 VOTES

GSAS21 Scientific Poster Contest



Digital assessment of soil salinity across Paraguay

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INTRODUCTION

Salinization represents an important form of soil degradation. According to FAO and GTSC, 2015, salinity and sodicity are one of the most important threats to soil health. Paraguay has two different hydroclimatic regions. The Western Region with dry climate, 850mm average rainfall and the Eastern Region with humid climate (Graessl, B., 2020). Although the presence of salts is known in Paraguay, a soil salinity map is not available. Therefore soil salinity mapping is a first step to generate new knowledge and monitor the expansion of soil salinity. Thus, the main objective of this study is to develop a digital soil salinity map at the national level in Paraguay.

METHODOLOGY

The methodology used to map salt affected soils (SAS) was based on the Global Soil Partnership approach proposed by the Global Soil Partnership (Ortiz et al., 2021), which emphasizes three steps: a) harmonization of input data, b) spatial modeling of input soil indicators using spatial predictors, and c) classification of soils affected by salts. The study data included 60 soil sampling sites with measured EC, values and 264 sites with measured pH and PSI values that are standardized to 0-30 deep. Environmental predictors remote sensing, imagery, thematic maps, geomorphometry and climate surfaces. The algorithms used for modeling is an ensemble of regression trees based on bagging known as Quantile Regression Forest.

Table 1. Percentages of coverage of soil classes of Electric Conductivity of soils in Paraguay, based on 30 cm depth.

Class	%
0.02 - 0.75	99
0.75 - 2.00	0.9
2.00 - 2.30	0.1

RESULTS

Most of the soils of Paraguay (97.49%), at depths of 0 to 30 cm, do not present salinity or sodicity. However, low sodium levels can be observed in soils of the lower chaco, likewise low salinity levels are found east of the middle chaco, occupying only 1.60% and 0.01% of the national territory, respectively. Thus our results represent a first benchmark to assess the expansion of salt affected soils across the country. The presence of salts and sodium in soil of Paraguay could indicate relation to the level of soil moisture, however, Abadomani and Zetina M. Al-Ali 2020 also mention that the amount of precipitation is closely related to the salinization of soils.

Table 2. Homogeneity of coverage of soil classes of Exchangeable Sodium Percentage, based on 30 cm depth.

Class	%
0 - 15	98.40
15 - 30	1.60

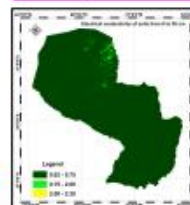


Fig. 1. Soil Salinity Distribution map, 0 to 30 cm, deep to Paraguay.

CONCLUSIONS

The first salinity and sodium map of soils in Paraguay shows the highest concentrations are found in the western region or the Paraguayan Chaco. Considering the scale of this first work, the low quantity and little updating of available data, as well as the depth superficial study, it is recommended to promote monitoring programs with information more detailed, updated and with more in-depth studies.

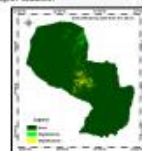


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Using water hyacinth as soil amendment to reclaim and boost productivity of calcareous sodic soils

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INTRODUCTION

- It is difficult to reclaim calcareous sodic soils having high clay content through chemical amendment and also the availability of mineral gypsum is scarce and costly for agricultural use in present times.
- The water hyacinth having more than 80% organic matter is commonly available in village ponds and is of no use. The sludge soils of Bihar state and parts of UP and Punjab in Indo-Gangetic plains are dominated by high CaCO₃ content.
- They have high sodium saturation that adversely affects the water utilization and soil structure. Availability of soil CaCO₃ may be quite considerable for the amelioration of sodic soils.
- Also, it has been reported that soluble CaCO₃ had significant contribution towards increase in exchangeable Ca²⁺ of sodic soils. The use of organic matter has long been advocated as an organic amendment for the reclamation of these soils since it tends to improve soil aggregation, aeration and water holding capacity.
- Consequently the production of CO₂ during decomposition of organic matter can lower the pH and lead to dissolution of CaCO₃.
- The present study was, therefore, undertaken to study the effect of organic matter on CaCO₃ dissolution and for predicting Ca²⁺-Mg²⁺ release from sodic soils which are in CaCO₃ content.

METHODOLOGY

In an incubation study on calcareous sodic soil (pH 8.4 to 8.8, EC 2.42 to 4.36 dS m⁻¹, CaCO₃ 2.2 to 26.10%, organic carbon 0.22 to 0.38%). The soil samples were amended with water hyacinth @ 250g ha⁻¹ in field capacity moisture and incubated at 28±0.5°C for 60 days.

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GSAS21 Photo Contest



- ✓ Photo contest launched this summer
- ✓ + 200 pictures received
- ✓ Open for online voting on facebook

... And the winners are:



1st PRIZE

"Sodification with high RSC irrigation waters" by Ajay Bhardwaj, India

A photograph showing a person's hands holding a small amount of dark soil. The person is wearing light-colored trousers and a black sandal. The ground is covered in a dense network of deep, irregular cracks, indicating severe soil salinity or drought. Sparse green vegetation is visible around the cracked areas. The text "2nd PRIZE" is overlaid in the top right corner.

2nd PRIZE

"Demonstration of the internal impact of soil salinity" by Gideon Américo Muiambo, Mozambique

A photograph showing a cross-section of soil. A dark, dense, and crumbly soil mass is being lifted, revealing several bright yellow, segmented earthworms (likely Lumbricus terrestris) within it. The worms are positioned at various depths within the soil profile. Above the soil mass, a metal tool, possibly a shovel or auger, is visible, having just dug up the sample. The background shows a mix of dry grass, soil, and a person's brown boot, suggesting an outdoor field setting. The text "3rd PRIZE" is overlaid in large, bold, black letters at the top of the image.

3rd PRIZE

"Soil surface sealing" by Julian Isasti, Argentina



"Relics of the ocean" by Guillermo Andrés Schulz, Argentina



"Kulans on salt marshes" by Ernes Kurtveliev, Uzbekistan



"Snow on the Hetao Plain in Summer" by Jingrou Xiao, China



"Salt marshes" by Ernes Kurtveliev, Uzbekistan



"Salt of the earth" by Ernes Kurtveliev, Uzbekistan



"The remains of the Ayazkol lake" by Mariya Gritsina, Uzbekistan



"Saline seepage" by Julian Isasti, Argentina



"Hetao Plain in Neimeng Province" by Long Guo, China



"Effect of sodification and salinization on soil, agriculture and the economy" by Israel Smart, Nigeria



"Soil salinization of wheat field with the first irrigation"
by Mehrnoush Eskandari Torbaghan and Abdolhamid Sherafati, Iran



"Soil salinization is real" by Shahzoda Alikhanova, Uzbekistan



"Aralkum veins" by Mariya Gritsina, Uzbekistan



"Salt marsh at sunset"
by Ernes Kurtveliev, Uzbekistan



Food and Agriculture
Organization of the
United Nations



GLOBAL SYMPOSIUM ON SALT-AFFECTED SOILS

20 - 22
October, 2021
Virtual meeting

